**SHORT TERM EFFECT OF KINESIOTAPING IN CHILDREN WITH FLEXIBLE FLAT FOOT**

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**CHENNAI**

# CERTIFICATE

This is to certify that the research work entitled SHORT TERM EFFECT OF KINESIOTAPING IN CHILDREN WITH FLEXIBLE FLAT FOOT was carried out by Reg. No.411513006, KMCH College of OccupationalTherapy, towards partial fulfillment of the requirements of Master of OccupationalTherapy (Advanced OT in Pediatrics) of the Tamil Nadu Dr. M.G.R. MedicalUniversity, Chennai.

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"Commit to the Lord whatever you do, and your plans will succeed "

Proverbs 16:3

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# ABSTRACT

**Background:** Flatfootmay exist as an isolated pathology or as part of a larger clinical entity. These entities include generalized ligamentous laxity, neurologic and muscular abnormalities, genetic conditions, collagen disorders and structural disorder. Flat foot is found to be associated with pronated foot.

**Objective:** The aim of the study was to determine the short term effect of kinesiotaping and custom made medial arch support in correcting flexible flatfoot

**Method:**A quasi experimental pre-posttest design was adopted for the study in which 20 children with flexible flatfoot were recruited out of which 10 children in the experimental group underwent kinesiotaping and 10 children in the control group were provided with medial custom made medial arch support . The study duration was 4 weeks wherein the tests were conducted across four timelines-pretest, mid test, posttest and a final follow up test. The scales administered were ChippauxSmirak Index and Navicular Drop test. There were 6 sessions of intervention wherein the tape was applied for three days a week after which a one day gap was given.

**Results:** Experimental group showed significant in reduction of CSI and NDT.No significant difference was found between groups ($p>0.05$).However, the reduction of CSI and navicular drop test was slightly more in experimental group when compared with control group.

**Conclusion:** The study concluded that kinesiotaping and custom made medial arch were found to be effective in children with flexible flatfoot preschool aged children aged 3-6 years.

**Key words:** Flatfoot, kinesitape, custom made medial arch support

# INTRODUCTION

Feet, is the body's base of support and it constantly endures high ground reaction forces that is generated during activities of daily living [1]. The human foot arch is a complex structure offering elasticity for shock absorption as well as stability for transmitting muscle force while walking [2].A structurally aligned foot is considered to be a normally arched foot [3]. This arch comprises bony articulations, ligaments and muscles. The muscles provide a secondary support by maintaining the arch during dynamic tasks. Ligaments offer a greater resistance to stress compared to muscles and rarely undergo physiological fatigue [1].The formation of the arch plays a role in static and dynamic stability and it is associated with the complete development of the foot bones, ligaments, and muscles [4].

Pes plano valgus (flatfoot) refers to a condition that is characterized by flattening of the medial longitudinal arch, along with hind foot valgus and it is common in both pediatric and adult populations [5]. Flatfoot can be divided into rigid flatfoot and flexible flatfoot. In rigid flatfoot the arch of the foot is always flat when one is in a weight-bearing or non-weight-bearing position, and it will result in pain or other discomfort[6].Whereas in flexible flat foot, the arch of the foot is flat only in a weight-bearing position; in a non-weight-bearing position, the foot arch is the same as in the case of a normal foot[6]. In children, flexible flatfoot has been regarded as a physiological deviation rather than a disorder, and the foot arch develops along with body growth. But some children with flatfeet may not develop a good foot arch at skeletal maturity, and according to a few studies this leads to inferior physical fitness[2] .Flexible flatfoot usually occurs in both feet and generally progresses in severity throughout the adult age. The soft tissues (tendons and ligaments) of the arch may stretch, tear and can become inflamed as the deformity worsens. Many factors can lead to the development of flat feet including obesity, the type of shoes a child wears, a child's sitting or sleeping position, compensation for other abnormalities further up the leg, or due to rupture of ligaments or tendons in the foot[1].

Foot and ankle specialists state that flatfoot deformity is a frequently encountered pathology in the pediatric population [5]. Flatfoot may lead to abnormal gait, and may exist as an isolated pathology or as part of a larger clinical entity which includes generalized ligamentous laxity, neurologic and muscular abnormalities, genetic conditions and syndromes, and collagen disorders[5]. Flatfoot may lead to pain in the heel, knee, hip, and the back [7]. Flat foot exhibits a more pronated gait which is characterized by excessive foot eversion, flattening of the medial longitudinal arch and limited first toe dorsiflexion and these deviated foot movements can be the pre-cursor to foot injuries[3]. The foot remains pronated for a prolonged period of time during the gait cycle as subtalar and midtarsal joints exhibit movement beyond the normal range of motion[3].

Several rehabilitative measures are available currently to treat flexible flatfoot. One of the recently effectivemethod is kinesiotaping developed by Mr. KenzoKase. Several studies have been conducted on kinesiotaping in treating flatfoot and most of the studies have shown positive results. But, very few studies were conducted in paediatric population and this study was aimed to determine the effectiveness of kinesiotaping for flexible flat foot in a population of 3-6 years old children.This age group was considered because of the maximum range (44%) of prevalence of flexible flat foot.

Kinesiotaping has recently become popular for the management of musculoskeletal impairments, including foot pronation. Kinesiotaping is designed to mimic the qualities of human skin. Unlike rigid tape, which is used for most of the traditional taping techniques, kinesiotaping has comparable thickness to the skin epidermisso that body perception of the tape is limited. The participant does not perceive the tape approximately ten minutes post-application[4].

The tape can be stretched longitudinally to 55-60% of its original length, and its elastic qualities make it effective for 3-5 days after application. The cotton fibers of kinesiotape allow for evaporation of body moisture and quick drying so that the tape has better adhesive ability during exercise and can also be worn while swimming or bathing. Claims for kinesiotape state that proper application to the skin will assist the body to function normally which means that although the tape may not place the body in a position it is used to; its tension will place the body in a position so that its kinetics function normally to limit pain or injury. Different applications of kinesiotape can facilitate or inhibit a muscle, limit edema and pain. Kinesiotape has also been found to aid in obtaining proper alignment in the body, increase the active range of motion in joints with weakened muscles, and affect the timing of activation of muscles [8].

In the present studykinesiotape is being applied for the experimental group of children, on the other hand, control group of children were provided with custom made medial arch support that were worn under the heel within a well fitted footwear. If kinesiotaping was found to be effective, then it could be a simple alternative for custom made foot arches.

## Need for study

- Prevalence of flexible flat foot in preschool aged children (3 to 6 year-old) was 44%.[11.] Thus taking adequate measures to correct the flat foot at an early age is necessary so that it will not affect the child in the later stages of life.
- There is a significant reduction of navicular drop in children treated with kinesiotape and foot strengthening exercises.[14] This study highly supported the use of kinesiotaping in children with flexible flat foot.
- Previous studies have explored the effectiveness of kinesiotaping in school aged children (10-12 years) and in adults but there is a lack of sufficient literature showing effectiveness of kinesiotaping in the preschool aged children. So this study intended to evaluate the effectiveness of kinesiotape in improving the medial arch in children between the age group of 3 to 6 years and also emphasizes on finding its effect within a minimum duration ie., 4 weeks.

# RESEARCH QUESTION:

Will short term application of kinesiotape help to develop medial arch in children with flexible flatfoot?

# AIM & OBJECTIVES

**AIM:**

To find out the short term effect of kinesiotaping in improving medial arch of children with flexible flatfoot.

**OBJECTIVES:**

- To evaluate the effect of kinesiotaping and custom made medial arch support in correcting flexible flat foot.
- To determine the short term effect of kinesiotaping and custom made medial arch support in correcting flexible flatfoot.
- To compare the effectiveness of kinesiotaping and custom made medial arch support.

# HYPOTHESIS

**Alternate hypothesis:**

Kinesiotaping will be effective in improving flexible flat foot in children.

**Null hypothesis**:

Kinesiotaping will not be effective in improving flexible flat foot in children

# OPERATIONAL DEFINITIONS

**Flat feet**

It is also called pes planus or fallen arches which is a postural deformity in which the arches of the foot collapse, with the entire sole of the foot coming into complete or near-complete contact with the ground.

**Flexible flatfoot**

The term "flexible" means that while the foot is flat when standing (weight bearing), and the arch returns when not standing.

**Kinesiotape:**

It is an elastic cotton strip with an acrylic adhesive that is used for treating athletic injuries and a variety of neuromuscular and musculoskeletal disorders. (KenzoKase)

**Kinesiotaping Method**

It is a definitive rehabilitative taping technique that is designed to facilitate the body's natural healing process while providing support and stability to muscles and joints without restricting the body's range of motion as well as providing extended soft tissue manipulation to prolong the benefits of manual therapy administered within the clinical setting.

**Medial arch support**

A rigid support made up of soft material(micro cellular rubber, ethaflex or silicon material) place inside a foot wear so that its molded form fits the arch of the foot and relieves stretch and strain on the muscles and ligaments of the foot while walking and standing.

# RELATED LITERATURE

Pes planus or flat feet is a postural deformity relating to the collapse or flattening of the medial longitudinal arch. It can also be referred to as hyperpronation or overpronation. Pes planus results in the midfoot region pronating towards the ground, and in some cases touching the ground completely. Although there are varying degrees of collapse, people are still able to live completely pain-free with flat feet.Flat feet progress slowly as the feet's exposure to weight-bearing activities increases. The two most common progressions from flat feet are foot deformities and bony stress injuries.

Flat Feet leads to conditions such as:

- Tibialis Posterior Tendinopathy
- Medial Tibial Stress Syndrome
- Achilles Tendinopathy
- Patellofemoral Pain Syndrome

**Causes of flat feet**

This condition can be congenital (e.g. from birth) or acquired (e.g. adults, increased exposure to weight-bearing).

***Congenital flatfeet*** occurs when a child is born with or predisposed to having a more flexible midfoot region resulting in pronation or collapsing of the arch.

***Acquired flatfeet*** is caused by a loss of active (e.g. intrinsic foot and ankle stabilizers) or passive support (ligamentous laxity, hypermobile joints) during dynamic weight-bearing activities. Muscular insufficiency in the ankle and arch stabilizers are the most common etiological factor for flat feet. Research suggests the tibialis posterior muscle is the most integral in stabilizing the medial longitudinal arch, via its insertion into the bony roof of the arch. When the arch stabilizers are performing sub-optimally, when weight and force are applied down through the foot, the arch slowly pronates and flattens towards the ground.

**Anatomy of the feet**

With a flatfoot deformity, bones, ligaments, and muscles are all affected. A combination of malalignments results in the flatfoot appearance.

### *Bones*

The skeleton of the foot begins with the talus, or ankle bone, that forms part of the ankle joint. The two bones of the lower leg, the large tibia and the smaller fibula, together at the ankle joint form a stable structure known as a mortise and tenon joint. The hindfoot involves the talus and the calcaneus, or heel bone. The talus is connected to the calcaneus at the subtalar joint. The subtalar joint allows the foot to rock from side to side. People with flatfeet usually have more motion at the subtalar joint than people who do not have flatfeet. The increased flexibility of the subtalar joint results in many compensatory actions of the foot and ankle in order to keep proper foot alignment during standing and walking. Just down the foot from the ankle is a set of five bones called tarsal bones. The tarsal bones are connected to the five long bones of the foot called the metatarsals. Finally, there are the bones of the toes, the phalanges.

### *Ligaments and Tendons*

The large Achilles' tendon is the most important tendon for walking, running, and jumping. It attaches the calf muscles to the heel bone to allows the person to rise up on toes.

The posterior tibial tendon attaches one of the smaller muscles of the calf to the underside of the foot. This tendon helps support the arch and allows to turn the foot inward. Failure of the posterior tibial tendon is a major problem in pes planus.

The spring ligament complex is often involved in the flatfoot condition. This group of ligaments supports the talonavicular joint. The spring ligament complex works with the posterior tibial tendon and the plantar fascia to support and stabilize the longitudinal arch of the foot. Failure of the ligaments that support this arch can contribute to flatfoot deformity. Injury, laxity (looseness), or other dysfunction of the ligament and tendon structures can result in deformity of the foot and/or ankle resulting in pes planus.

### *The arches of the foot*

The foot has to act as a pliable platform to support the body weight in upright position, it also acts as a lever for forward propulsion during walking, running or jumping. To meet these requirements the foot is designed in the form of elastic arches. These arches are segmented and concave sothat they can sustain the stresses of weights and thrusts. The arches add elasticity and flexibility to the foot by allowing the midfoot to spread and close. The arches are formed by bones, ligaments, muscles, tendons and aponeurosis. There are two types of arches ie., longitudinal arch and transverse arch.

***Longitudinal arches***

Longitudinal arches lie in the long axis of the foot ,one on medial side and other on lateral side with calcaneum as common posterior pillar.

***Medial longitudinal arch***: This arch is considerably higher, more mobile and resilent than the lateral. It absorbs forces of weights and thrusts. The line of the medial arch is calcaneum – talus-navicular-cuneiforms-inner three metatarsals. Its constitution is as follows:

- Ends : The anterior end is formed by the heads of the first three metatarsals. Posterior end is formed by medial tubercle of calcaneum.
- Summit : Formed by superior articular surface of the body of talus
- Pillars: anterior pillar is long and weak. Its formed by talus, navicular, three cuneiforms and first three metatarsals. The posterior pillar is short and strong. Its formed by the medial half of calcaneum.
- Main joint of the arch is talo-calcaneo-navicular.

***Lateral longitudinal arch***: This arch is low, has limited mobility, and is built to transmit weight and thrust to the ground. The line of lateral arch is calcaneum –cuboid-outer two metatarsals. The constitution of the lateral longitudinal arch is as follows:

- Ends: The anterior end is formed by the heads of the fourth and fifth metatarsals and the posterior end ,by the lateral tubercle of calcaneum.
- Summit : the articular facets on the superior surface of calcaneum forms summit
- Pillars: the anterior pillar is long and weak. It is formed by the cuboid and the fourth and fifth metatarsals. The posterior pillar is short and strong. Its formed by the lateral half of calcaneum.

***Transverse arches:***

Transverse arch is the side to side concavity seen in cross section and is most marked at the bases of metatarsals. There are two transverse arches:

***Posterior transverse arch***: It is formed by the greater parts of tarsus and metatarsus.it is incomplete as only the lateral end comes in contact with the ground.

***Anterior transverse arch***: It is formed by the heads of the five metatarsal bones

***Functions of arches***

- They distribute body weight to weight bearing areas of the sol namely heel, balls of toes (maily first and fifth) and lateral border of the foot.
- Elasticity of arches (mainly medial longitudinal arch) help in walking and running
- Springs of arches act as shock absorbers in stepping and jumping
- Concavity of arches protects the soft tissues, nerves and blood vessels in the sole.

***Effects of pes planus on foot dynamics***

Collapse of the medial longitudinal arch everts the calcaneus in relation to the talus, so that the foot pronates. Affected patients usually also have:

- Valgus position of the heel and forefoot (turned outwards); and
- Hyper pronation of the midfoot.

Hyperpronation moves the transmission of force medially as the weight is transferred forwards on to the walking foot. This can stretch the soft tissues behind the medial malleolus (the posterior tibial tendon and posterior tibial nerve) which can lead to tendinopathy and nerve entrapment. The collapsed arch can also stretch the spring ligament and plantar fascia, leading to plantar fasciitis. Compensatory abduction of the forefoot, together with altered transmission of weight through the foot, can lead to hallux valgus and metatarsalgia.

***Diagnosis:***

The key to diagnosis in flat foot problems is to determine whether or not the pes planus is flexible or rigid. A flexible flat foot will reconstitute a nice arch when standing on tiptoe or in stance phase, by elevating the first metatarsophalangeal joint. This is a so-called joint jack test and when the great toe is flexed up towards the ceiling, medial arch reappears on the foot. In addition, a flexible flat foot has a supple subtalar motion.

In the rigid flat foot, the subtalar range of motion is stiff and restricted and the arch does not reconstitute when standing on tiptoe or performing the joint jack test. In all cases of foot problems, a careful neurological exam needs to be done.

The history and physical examination are tools the physician uses to diagnose this condition. Clinical tests can be done to differentiate flexible flatfoot from rigid flatfoot. The examiner will check mobility in the forefoot, hindfoot, and ankle. Muscle weakness and/or muscle tightness will be assessed.

***Flat Feet Treatment***

- Restore Intrinsic Muscle Control and Foot Arch Biomechanics
- Dynamic Foot Posture Exercises
- Passive Arch Support / Orthotics
- Kinesiotaping

# REVIEW OF LITERATURE

**Prevalence of flatfoot in children**

**A study on prevalence of flatfoot among school students and its relationship with Body Mass Index done by Mohsen pourghasaem(2015):** The purpose of this study was to analyze the relation between the flat-footedness and obesity. 1158 school children (653 male and 505 female) participated in the study. Diagnosis and severity of flatfoot was assessed using the Dennis method. The findings suggest that obesity at a younger age could be a cause of flatfoot and decreasing the prevalence of flatfoot could be possible by controlling the Body Mass Index.

**A study on evaluation of children with flatfoot on the basis of clinical features, footprint analysis and imaging studies done by Vinay N et al (2015) :**The purpose of this study was to evaluate all children with flatfoot on the basis of clinical features, footprint analysis and imaging studies. The age of the study group was taken from 6 months to 16 years. A total of 30 cases were screened and evaluated by foot print analysis. Next the subjects were evaluated for type based on clinical findings into flexible and rigid flatfoot severity, using Volpes Treatment Classification Systeminto mild, moderate and severe. Further subjects were analysed by calculating arch index from footprints and radiographic angles. The findings of the study was that most of the flexible flatfoot were severe type and the next being moderate type based on Volpes classification. The maximum number of severe type was seen in age group between 6 months and 8 years. The study also concluded that younger the age group, more was the severity.

**A study onprevalence of flexible flatfoot among school-age girls done by KagnooshHomayouni et al (2015) :**The study was done to establish the prevalence of flatfoot in a population of school-age children whichincluded 290 school girls aged 6 to 11 years, and evaluate cofactors such as age and joint laxity that might affect its development. For the assessment of flatfoot, navicular drop test was used. The generalized joint laxity was measured by Beighton score. This study concluded that younger school aged children with excessive joint laxity are more predisposed to develop flatfoot.

**A study on an investigation of the factors affecting flatfoot in children with delayed motor developmentdone by Kun – Chung et al (2014) :** This study was done to determine the prevalence of flatfoot in children with delayed motor development and the relevant factors affecting it. A total of 121 preschool-aged children aged 3–6 with delayed motor development (male: 81; female: 40) were included in the motor-developmentally delayed children group. The judgment criterion of flatfoot was the CSI> 62.70%, in footprint measurement. The findings of the study showed that the prevalence of flatfoot was higher in preschool-aged children with delayed motor development than in normal children and that children with both excessive joint laxity and delayed development are more likely to suffer from flatfoot.

**A study onflatfoot diagnosis by a unique bimodal distribution of footprint index in children done by Chia-Hsieh Chang et al, (2014):** The purposes of this study were to establish a new classification of flatfoot by characteristic in frequency distribution of footprint index and to endurethe classification with discrepancy in physical fitness. 1228 school-aged children were included in the study. The findings revealed how well the natural bimodality lends itself to the classification of footprint in children and the bimodality suggests that the development of human foot structure is not a continuous process as gaining height and weight, but rather a leap from one state to another.

**A study on Analysis of ankle alignment abnormalities as a risk factor for pediatric flexible flat foot done by Dr. Ajai Singh et al. (2010):** This study was done to analyse the ankle rotational mal-alignments in the natural course of flexible flat foot in children. Seventy-six subjects with flexible flat foot and one hundred controls were included in this study. The height of foot arches was judged clinically by inspecting the height of the medial arch and by measuring the arch index on weight-bearingpodograms. The findings of the study were -arch index is a better parameter than clinical observation in the evaluation of the deformity, external tibial torsion was associated withflexible pediatric flat feet, hind foot rotational mal-alignment (high talar spin) was associatedwith severity of collapse, the mal-alignment makes these deformities more complex and lessresponsive to conservative treatment.

**A study onrelationship between obesity and flatfoot in high-school boys and girlsdone by Hassan Daneshmandi et al (2009):** The aim of this study was to determine the relationship between obesity and flatfootamong high school students.180 students (726 boys and 454 girls) were included in this study.Measurement of height and weight of the students was done by using standard apparatus and foot structure assessment was performed with DenisMethod. The findings of this study suggest that prevalence of overweight can be the cause of flatfoot at age of 12 – 15 years thus parents should pay attention to overweight in these ages.

**A study onprevalence of flat foot in preschool-aged children by Martin Pfeiffer et al (2006):** The purpose of this study was to determine the prevalence of flat foot in a population of children aged 3 to 6 years to evaluate cofactors such as age, weight, and gender. 835 children (411 girls and 424 boys) were included in this study. The clinical diagnosis of flat foot was based on a valgus position of the heel and a poor arch formation . The findings suggest that the prevalence of flat foot is influenced by age, gender, and weight. A highly significant prevalence of flat foot was observed in overweight children and in boys and also a retarded development of the medial arch in the boys was discovered.

**A study on footprint analysis between three and seventeen years of agedone by Francisco Forriol et al (1990):**In this study footprints of both feet were analyzed from 1676 school children , agedbetween 3 and 17 years (1013 girls and 663 boys). In each footprint the Footprint Angle and theCSI were obtained. The results show an increase in the Footprint Angle, and a decrease in the CSI up to the age of 9 in both sexes and both feet are observed. The findings also conclude that the normal medial longitudinal arch of the foot should have developed with the correction of the physiological genu valgum by age of 5 or 6.

**Kinesiotaping for flatfoot**

**A study onimmediate effects of kinematic taping on lower extremity muscle tone and stiffness in flexible flat feet by Joon- San Wag et al (2004):**This study was conducted to examine the immediate effects of kinematic taping on the tone andstiffness in the leg muscles of subjects with flexible flat feet. 30 subjects, 15 in thekinematic taping and 15 in the sham taping group, were administered respective taping interventions. The findings demonstrated that kinematic taping on flexible flat feet had positiveeffects of immediately reducing the abnormally increased foot pressure and the tone and stiffness in the lower extremity muscles.

**A study oncomparison of foot taping versus custom-made medial arch support on pronated flatfoot in school going childrendone by Vadivelan K et al (2015):** The purpose of the study was to compare the effectiveness of foot taping versus custom-made medial arch support on pronated flatfoot in school going children. For this study 60 students aged 10 to 12 years were selected on the basis of inclusion criteria and divided into three groups –group A which received custom-made medial arch support and foot strengthening exercises, group-B which received kinesiotaping and foot strengthening exercises and group-C which received foot strengthening exercises for 4 weeks.The findings of the study showed that foot taping, custom-made medial arch support and foot strengthening exercises were found to be effective on pronated flatfoot in school going children aged 10 to 12 years.

**A study on effect of taping on foot structure, functional foot stability and running gait patterns of the foot done by Malia ho tsaidjun et al (2015):**

The purpose of this study was to investigate if taping would improve foot structure, functional foot stability and reduce the excessive foot movements during running. Twenty-two subjects (both males and females) were selected and had their foot structure identified as: flat foot stable, flat foot unstable and normal arched unstable according to the FPI (foot posture index) and the Modified Romberg's Test with the BESS (balance error scoring system) criteria. Then the subjects ran on an instrumented treadmill barefooted with their feet taped and untaped. The findings showed that taping improved foot structure but not functional foot stability. It was found that during running, taping significantly reduced rearfoot eversion. Taping also increased the loading rate in the flat foot and normal arched unstable groups but reduced the loading rate for the flat foot stable group.

**A study on Foot Taping versus Medical Shoes on Kinematic Gait Parameters In Children With Down's Syndromedone by samiha et al,2014.**

The purpose of this study was to assess the difference between taping and medical shoes as means of foot arches support. Thirty children with DS were randomly recruited and assigned to one of the next two groups; DS taping and DS shoe group. Kinematic gait parameters were measured before using assigned interventions and during application of interventions using footprint analysis. They showedimproved gait parameters(velocity, Base of Support, Stride length and Step length) in both groups during application of interventions compared to pre intervention measures. When both interventions were compared to each other no significant differences between groups were detected. Conclusion: both taping and medical shoe were equally effective in improving kinematic gait parameters in children with DS.

**A study onKinesio Tape has a positive effect on facilitation of the tibialis posterior muscle during walking gait done by ChyrstenRegelskin(2013):** The purpose of the study was to determine if kinesiotape facilitation of the tibialis posterior muscle on participants with excessive pronation will decrease navicular drop, talar eversion, and calcaneal eversion during walking gait. 25 participants with pronated feet (11 males and 14 females) were selected for this study. The intervention involved kinesiotape facilitation of the tibialis posterior muscle and a standard treadmill used for consistent walking surface at self-determined normal pace. The findings show that the kinesiotape facilitation of the tibialis posterior muscle is effective in decreasing in calcaneal eversion, navicular drop, and talar movement.

**Custom made foot arch for flatfoot**

**A study on some effects of foot orthoses on joint motion and moments, and ground reaction forces, by C.J. Nester et al (2014)**: The purpose of this study was to find out the effects of medially wedged foot orthoses (MWO) and laterally wedged foot orthoses (LWO) on joint kinematics and moments, and ground reaction forces. Fifteen subjects were selected for the study and each subject had to perform 10 gait cycles. The findings of the study suggest that both MWO and LWO had greatest effect on the kinematics and moments of the rearfoot complex, with some effects on the moments at the knee.

**A study oneffects of custom-made rigid foot orthosis on pes planus in children over 6 years old done bySoo-Kyung Bok et al., (2014)** The aim of this study was to identify the effects of a custom-made rigid foot orthosis (RFO) in children over six years old with pes planus. 39 children (average age, 10.3 years) diagnosed with flexible flat foot were included in this study. The resting calcaneal stance position (RCSP), anteroposterior talocalcaneal angle (APTCA), lateral talocalcaneal angle (LTTCA), the lateral talometatarsal angle (LTTMA), and calcaneal pitch (CP) of both feet were measured to evaluate foot alignment and then the children were fitted with a pair of RFOs and recommended to walk with heel strike and reciprocal arm swing to normalize the gait pattern. A follow-up clinical evaluation with radiological measurements was performed after 12–18 months and after 24 months of RFO application. The results of this study indicated that radiological indicators improved significantly after 24 months of RFO application.

**A study oneffect of custom-molded foot orthoses on foot pain and balance in children with symptomatic flexible flat feet by Hong – Jae Lee et al (2015):** This study was done to evaluate the effect of custom-molded foot orthoses on foot pain and balance in children with symptomatic flexible flat foot 1 month and 3 months after fitting foot orthosis. 24 children over 6 years old with flexible flat feet and foot pain for at least 6 months were included in this study. Their resting calcaneal stance position and calcaneal pitch angle were measured. Individual custom-molded rigid foot orthoses were prescribed. Pain questionnaire was used to obtain pain sites, degree, and frequency. Balancing ability was determined using computerized posturography. The study revealed that short-term use of custom-molded foot orthoses significantly improved foot pain and balancing ability in children with symptomatic flexible flat foot.

**A study oneffects of orthotic insoles on adults with flexible flatfoot under different walking conditions Jun Na Zhai et al (2016):**The aim of this study was to evaluate the effects of orthotics on adults with flexible flatfoot when wearingorthotic insoles while walking on horizontal ground, walking up and down stairs and to determine if flexibleflatfoot needs treatment. Fifteen college students with flexible flatfoot and fifteen collegestudents with normal feet were included in this study. After a treatment of three months the study concluded that orthotic insoles couldsignificantly improve the plantar pressure of flatfoot and that the arches of subjects with normal feet andflatfoot can be significantly deformed when walking down stairs. Thus, it is necessary for subjects with flexibleflatfoot to wear orthotic insoles to avoid needless injury.

**A study onmedial arch orthosis for paediatric flatfoot by Shivam Sinha et al (2012):** The aim of this study was to evaluate any correlation between various foot angles and their respective American Orthopaedic Foot and Ankle Society (AOFAS) scores for pain, and the effectiveness of a medial arch orthosis. 81 children with bilateral symptomatic flatfoot were recruited for the study and divided into experimental and control group. The orthosis group were given a medialarch support.The conclusion states that medial arch support orthosis significantly improved AOFAS scores and foot angles and also calcaneal pitch angle and lateral talo calcaneal angle correlated well with AOFAS hindfoot scores.

# CONCEPTUAL FRAMEWORK

Flexible flatfoot is a medical condition in which the entire sole of the foot comes into complete or near complete contact with the ground.

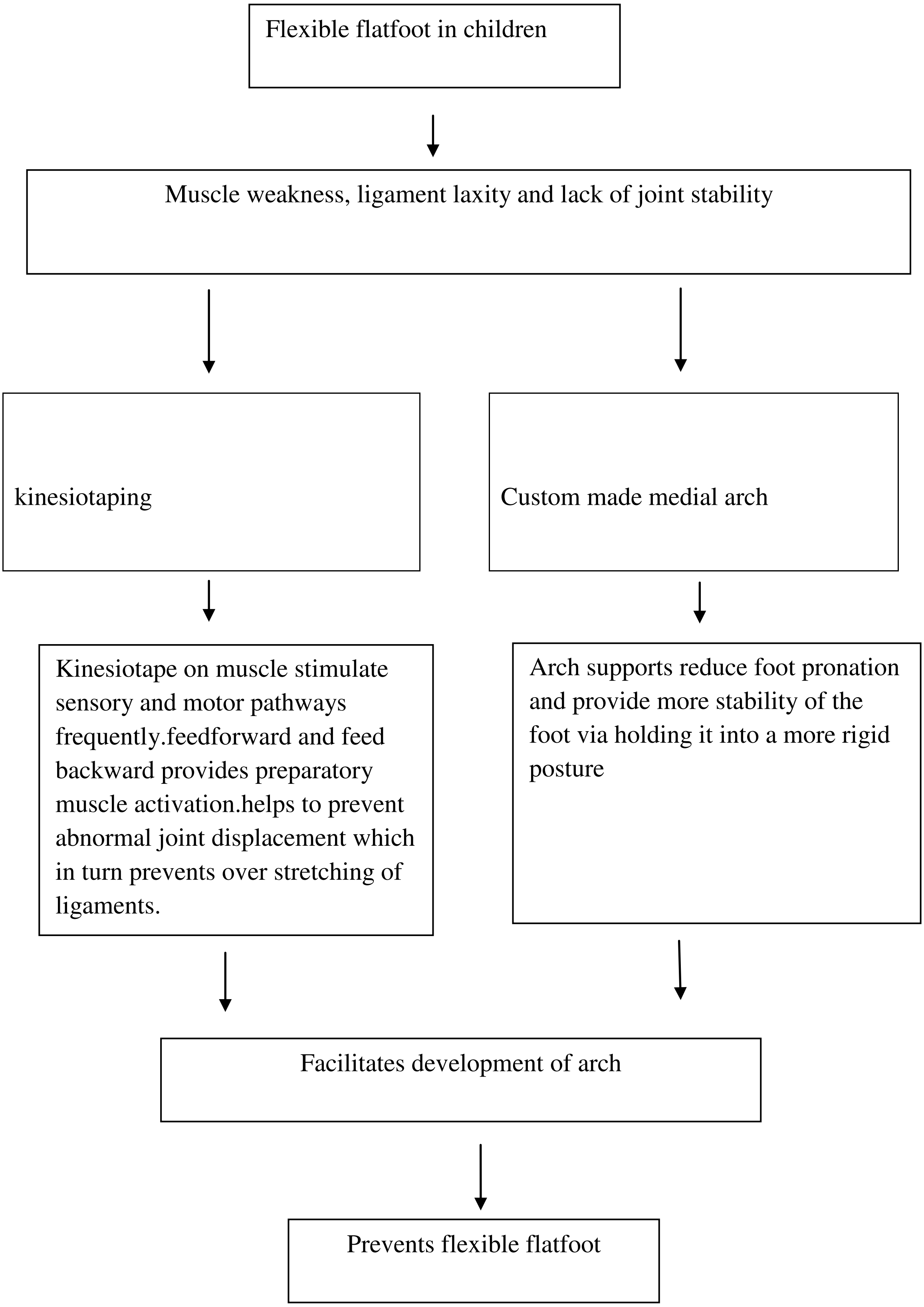
Poor muscle activity leads to lack of stability in the foot joints. This leads to displacement of the joint which leads to excessive stretch of the ligamental structure. Altogether this contributes the causative factor of flexible flat foot. Functionally flexible flat foot affects the balance and gait. One of the main implication of occupational therapy is the assessment of balance and gait and treatment implication of its causative factor.

Research has supported the effect of kinesiotaping in improving muscle strength. Kinesiotapinghas also been found useful to obtaining proper alignment of the body.[17,18,19,20] In a study by **Vadivelan, K et al., (2015)** it has been found that kinesiotaping is effective in facilitating activities of peroneous longus and stabilizing the lateral and medial mid foot and calcaneum in neutral position. This technique of kinesiotapingand its application are based on the biomechanical approach and utilized in the present study to correct flexible flatfoot in children between the age group of 3-6 years.

According to Dr. Kenzo Kase, the tape and taping method corrects muscle function by strengthening weakened muscles, reposition, subluxated joints by relieving abnormal muscle tension, helping to return function of fascia and muscle and increases proprioception through increased stimulation to skin mechanoreceptors. Based on neurophysiological approachKinesthesia, also known as position sense, is often coupled with proprioception and is defined as the awareness of the body in space or dynamic joint motion. Kinesthetic signals in response to body movements and tensions with in tendons arise from sensory receptors found in muscles, tendons, and joints[34,35]. This conscious and unconscious awareness that occurs with proprioception and kinesthesia is crucial to motor learning, muscle function, and reflex stabilization. There are two types of neuromuscular control[34].The first is feed-forward control which involves the ability to plan movements that are based on sensory information from past experiences. Feed-forward control provides preparatory muscular activation. The second type of neuromuscular control is feedback. Feedback is constantly regulating muscle activity through reflex pathways. This type of control provides reactive muscle activity. If sensory and motor pathways are stimulated frequently, feed-forward and feedback neuromuscular controls can enhance the dynamic stability[34]. This regular stimulation will create a memory of the signal so that the movement can be easily recalled.[34,35] Callaghan et al [36] investigated the effect of a constant stimulus on proprioception through the use of patellar taping and its effect on proprioception at the knee. Callaghan et al [36] found that there was an increase in brain response during proprioceptive activities during the taped condition versus the un-taped condition. The findings of the study show that the brain does react to a constant stimulus, although the researchers did not investigate the recall of the movement[36.] Apart from easy recall of movement, increased muscle activation will also increase the stiffness of the muscle, which in turn will improve stretch sensitivity of the muscle[34] Increased stiffness of muscles provide for a more effective resistance to joint displacement, as a result a joint that is supported by regularly activated muscles will have a decrease in dynamic range of motion[34].

Medial arch support resists depression of the foots arches by transferring a portion of the load to the medial structures of the foot .This reduces the tension in the plantar aponeurosis. According to biomechanical frame of reference position helps in preventing deformity. Arch supports

reduce foot pronation and provide more stability of the foot via holding it into amore rigid posture.


Flexible flatfoot in children
Muscle weakness, ligament laxity and lack of joint stability
kinesiotaping
Custom made medial arch
Kinesiotape on muscle stimulate sensory and motor pathways frequently.feedforward and feed backward provides preparatory muscle activation.helps to prevent abnormal joint displacement which in turn prevents over stretching of ligaments.
Arch supports reduce foot pronation and provide more stability of the foot via holding it into a more rigid posture
Facilitates development of arch
Prevents flexible flatfoot

# METHODOLOGY

**Research design:**

The aim of the study was to find the short term effectiveness of kinesiotaping in children with flexible flat foot hence used a quasi-experimental pre-posttest design.

Kinesiotaping was done for experimental group of children and control group was provided with custom made medial arch support.

Approval was obtained from the institutional review board of Kovai Medical Center and Hospital.

**Setting of the study:**

- This study was conducted in Occupational Therapy Department (Kovai Medical Centre and Hospital), clinics and therapy centers in and around Coimbatore.

**Duration of intervention:**

Intervention was carried out for 4 weeks and follow up was done for 15 days.

**Variables:**

- Independent variables – Kinesiotaping
- Dependent variables –Flat foot
- Extraneous variables – Therapy sessions including foot strengthening exercise, severity of illness.

**Sample size determination**

Sample size determination was based on previous study done by samiha et al(2014)

**Sampling:**

Convenient sampling technique was used on these samples available

**Sample size:**

The sample was randomly assigned to

- Experimental group: 10
- Control group: 10

**Selection Criteria**

**Inclusion criteria:**

- Children within the age group of 3 - 6 years with flexible flatfoot and who were able to walk independently.
- Children with low or absent arch on weight bearing as documented by foot print analysis.
- Both the gender

**Exclusion criteria:**

- Any past history of injury / treatment of the affected limb.
- Any other associated congenital abnormality
- Children with neuromuscular disorder(muscular dystrophy,pediatricmysthenia gravis and floppy infant syndrome, cerebral palsy, infantile hemiplegia , down syndrome ).
- Other obvious clinical alignment abnormality of that lower limb e.g. Genu varum / valgum.
- Limb length discrepancy.
- Obesity.
- Children already using foot orthosis for flatfeet deformity

## TOOLS, EQUIPMENTS AND OUTCOME MEASURES

***Baseline measure*:**

- Chippaux Smirak index
- Navicular drop test

***Outcome measure* :**

**ChippauxSmirak Index:**

- CSI as described by Forriol and Pascual was used to collect the anthropometric measures of the feet and to analyze the medial longitudinal arch.
- To calculate this index, two tangents were drawn: one through the most medial points and another through the most lateral points of the regions of the metatarsal heads and calcaneus.
- Next, two parallel straight lines were drawn: the first between the most medial and the most lateral points of metatarsal head region, thus obtaining the widest section of the impression (segment a); and the second over the narrowest section of the medial longitudinal arch (segment b). Both segments were measured, and the value of b was divided by a. For this index, the reference values were: 0 cm - cavus foot; 0.01 to 0.29 cm - normal foot; 0.30 to 0.39 cm - intermediate foot; 0.40 to 0.44 cm - lowered foot; and 0.45 cm or more - flat foot .
- The CSI had excellent inter-rater reliability ICC:0.98 and test retest reliability ICC:0.97

**Navicular Drop Test**

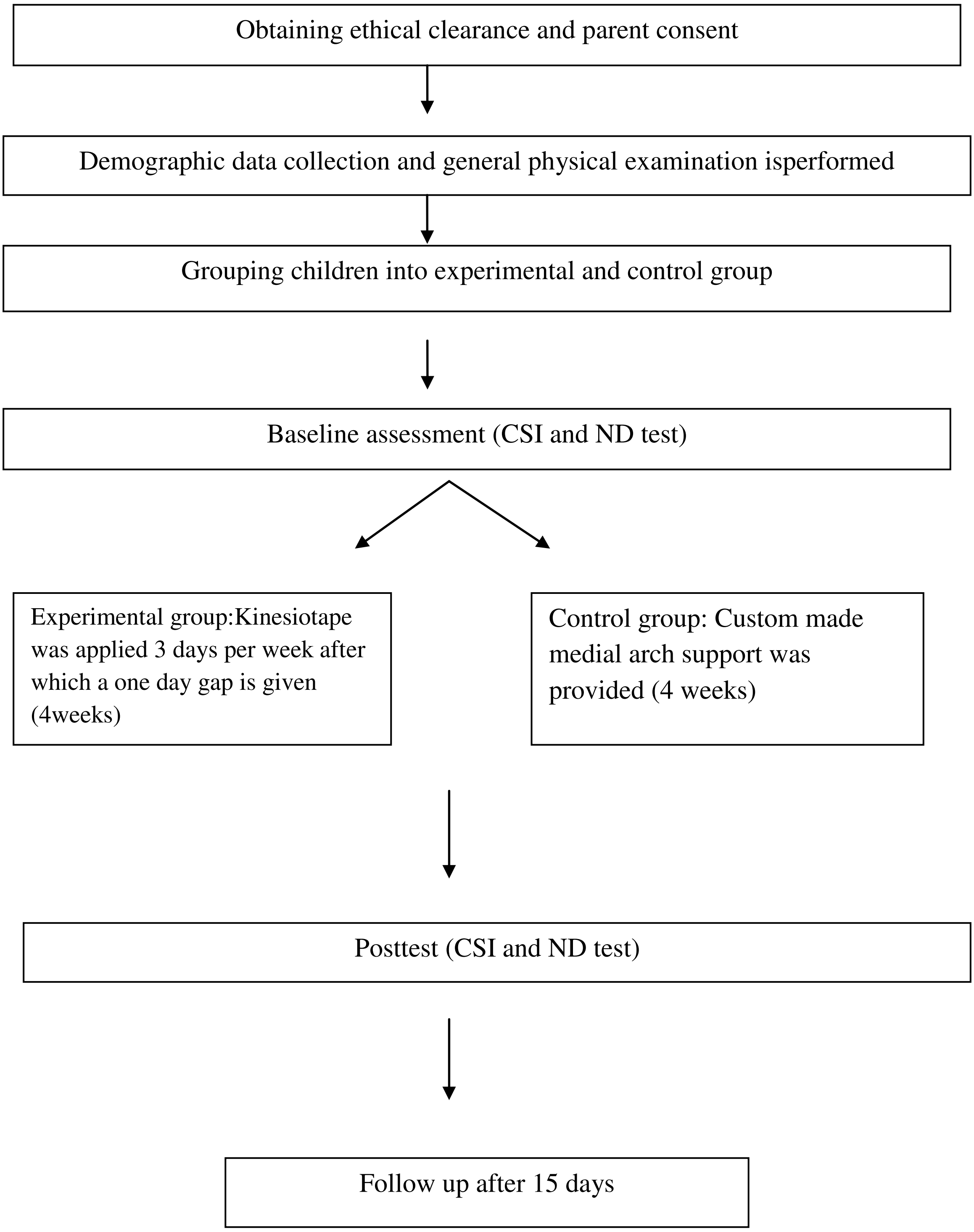
The ND test was performed by calculating the difference in height of the navicular from the floor when the sub talar joint was positioned in neutral and in a full weight bearing position. An navicular drop of 6-9 mm was considered being within the normal range and an navicular drop of >10mm was considered as abnormal result**.**

**Reliability:**

Vauhnik et al., (2006) reported a moderate to good intra-reliability of the ND test. Mean values of 0.5 cm in ND for right foot and 0.6 cm in ND for left foot were found, with intraclass correlation coefficients of 0.78 for the right leg and 0.88 for the left leg. Mueller et al., (1993) reported good intrarater reliability. Sell et al. (1994) found good intrarater and interrater reliability. They evaluated the reliability of measuring ND in 30 healthy subjects and reported a mean value of 0.6 cm in ND. Intraclass correlation coefficient for intra and inter-rater reliability were found to be 0.73 and 0.83.

**PROCEDURE**

***Summary of steps followed in the study:***

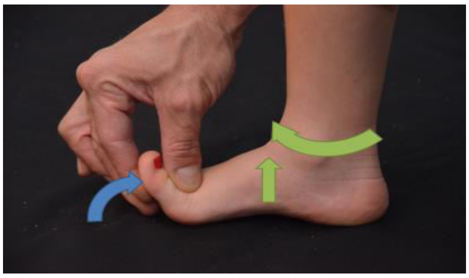


***General physical examination format:***

- Name :
- Age/sex :
- Date of birth :
- Height :
- Weight :
- Body Mass Index : Underweight/Normal/Overweight/Obese
- Medical history:
- Fixed foot deformity : Yes/No
- Orthopaedics intervention : Yes/No
- Injury or Pain in the lower limb : Yes/No
- Medial arch : Normal/Flat/Low
- Flexible flat foot

  (Jack test) : No/Flexible/Rigid

***Jack Test*:** A flexible flat foot will reconstitute an optimal arch when standing on tiptoe or in stance phase, by elevating the first metatarsophalangeal joint. This is called joint jack test and when the great toe is flexed up towards the ceiling, medial arch reappears on the foot.



**Intervention**

***Experimental group:***

Kinesiotape was applied to the experimental group.

- A patch test is done using kinesiotape to monitor response and integrity before starting the intervention.
- The intervention consist of **6 sessions** for **4 weeks**
- In each session the kinesiotape is applied for **three days** at a stretch (applied on 1st day and removed on the 3rd day) after which a **one day gap** is given, before the next kinesiotape application.
- Outcome measures are taken as Pretest ⟹ Mid test ⟹ Posttest ⟹ Final follow up after a gap of 15 days.

***Session 1:***

A pretest was done using CSI and ND test and then kinesiotape was applied.

Following are the steps in detail for the application of kinesiotape:

- Subjects were made to lie in the prone position with knee flexed at 90. Foot was placed in subtalar neutral position, minimal inversion and neutral dorsiflexion.
- Taping was done in prone with 3 or 4 "I" tapes, 2 inches wide. The first piece of tape was anchored on the lateral midfoot and then diagonally under calcaneus and medially around posterior ankle. This piece of tape helped to maintain calcaneus in a more neutral position and limit calcaneal eversion.

- The second piece of tape was anchored on medial midfoot and brought diagonally under calcaneus and laterally around posterior ankle which assisted to “lock” calcaneus in position or “close the loop” for sensory input
- The third piece of tape extended from the lateral midfoot, over navicular and up the medial distal third of the lower leg, just above the malleolus which supported the midfoot.
- The fourth piece of tape was applied to facilitate peroneus longus from origin to insertion. and the first ray was brought down (plantarflexion).

***Session 2 & 3:***

Application of kinesiotape

***Session 4****:*

Mid test using CSI and ND test was done and then kinesiotapewas applied

***Session 5****:*

Application of kinesiotape

***Session 6***:

Application of kinesiotape and then posttest was done using CSI and ND test.

**Post intervention**:

Follow up for 15 days.

***Control group*:**

Custom made medial arch support was fitted in the footwear (open toe sandals) worn by the children.

***Fabrication of medial arch support***: The medial arch support was fabricated at the Department of Occupational Therapy, KMCH

***Day 1:***

A pretest was done using CSI and ND test after which a custom made medial arch is provided.

***After 2 weeks:***

Mid test using CSI and ND test

***By the end of 4th week****:*

*Post test using CSI and ND test.*

***Post intervention****:*

Follow up for 15 days.

***Cost Analysis of kinesiotape:***

Material cost  -Rs.700/roll

Application cost- Rs.140/session

Total cost- Rs. 1100/sample

***Cost Analysis of medial arch support***

Material cost  - 100rs(5*6cm mcr sheet)

Application cost- Rs.10

Total cost- Rs. 150/sample

## DATA ANALYSIS AND RESULTS

This chapter discusses the analyses of the collected data. The aim of this study was to find out the short term effect of kinesiotaping in children with flexible flat foot

### Statistical description of the variables

For this study analyses were done using SPSS for windows (version 20.0). Descriptive analyses were performed to characterize the groups and inferential analyses to compare the performance of the groups (Mann Whitney U, Wilcoxon, Repeated measures ANOVA ) were used.

- Pretest, middletest,posttest,follow up test scores of experimental group and control group analyzed through the Mann Whitney U test.(table
- Pretest,Middletest,Posttest,follow up test scores of experimental group and control group analyzed through the Mann Whitney U test.
- Pretest,middletest,posttestand follow up test both experimental group and control group separately were analyzed using the Wilcoxon signed rank test.
- To compare the means of experimental group and control pre,middle,post and follow up and to find out the effect size with the help of the repeated measures ANOVA

  Effect size:$n_p^2$=F×$df_{effect}$/F×$df_{effect}$+$df_{error}$

An effect size of< 0.4 is considered to be a small effect

An effect size of >0.5is considered to be a medium effect

An effect size of >0.8 is considered to be a greater effect

**Table 1:** DEMOGRAPHIC DETAILS:

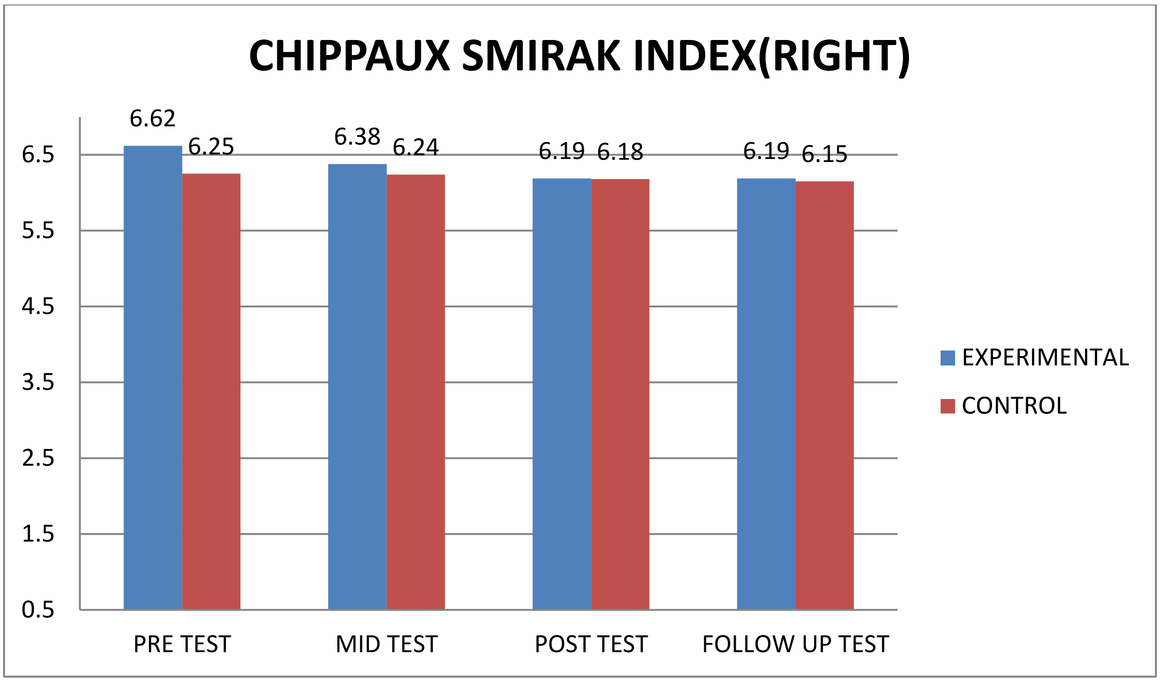
| | Group | N | Mean | S.D | Minimum | Maximum |
|---|---|---|---|---|---|---|
| Age | Experimental Group | 10 | 4.27 | .843 | 3.4 | 5.8 |
| | Control group | 10 | 4.61 | .732 | 3.5 | 5.7 |
| SEX | Experimental Group | 10 | 1.00 | .000 | 1.0 | 1.0 |
| | Control group | 10 | 1.20 | .421 | 1.0 | 2.0 |

**Table1**shows that values of the age and sexof the experimental and control group.

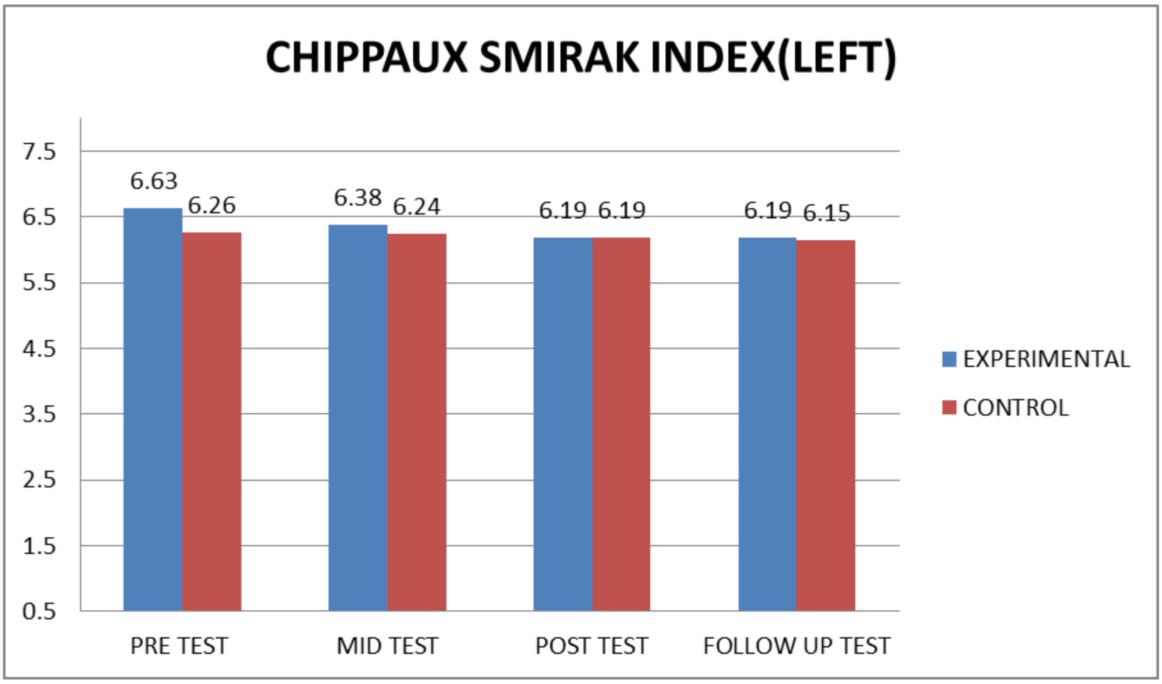
**Table 2:** Descriptive of the pretest ,mid test, post test and follow up scores of Chippauxsmirak index and navicular drop test of experimental and control group

| SCALES | Foot | Group | test | N | Mean | S.D | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| ChippauxSmirak Index | Right | Experimental Group | pre | 10 | 6.62 | 0.65 | 5.70 | 7.50 |
| | | | mid | 10 | 6.38 | 0.56 | 5.70 | 7.20 |
| | | | post | 10 | 6.19 | 0.51 | 5.40 | 7.00 |
| | | | foll | 10 | 6.19 | 0.51 | 5.40 | 7.00 |
| | | Control group | pre | 10 | 6.25 | 0.48 | 5.60 | 7.00 |
| | | | mid | 10 | 6.24 | 0.47 | 5.60 | 7.00 |
| | | | post | 10 | 6.18 | 0.50 | 5.40 | 7.00 |
| | | | foll | 10 | 6.15 | 0.50 | 5.40 | 7.00 |
| | Left | Experimental Group | pre | 10 | 6.63 | 0.63 | 5.80 | 7.50 |
| | | | mid | 10 | 6.38 | 0.56 | 5.70 | 7.20 |
| | | | post | 10 | 6.19 | 0.47 | 5.60 | 7.00 |
| | | | foll | 10 | 6.19 | 0.47 | 5.60 | 7.00 |
| | | Control group | pre | 10 | 6.26 | 0.46 | 5.70 | 7.00 |
| | | | mid | 10 | 6.24 | 0.47 | 5.60 | 7.00 |
| | | | post | 10 | 6.19 | 0.47 | 5.60 | 7.00 |
| | | | foll | 10 | 6.15 | 0.46 | 5.60 | 7.00 |
| Navicular drop test | Right | Experimental Group | pre | 10 | 8.80 | 1.54 | 7.00 | 11.0 |
| | | | mid | 10 | 8.70 | 1.49 | 7.00 | 11.0 |
| | | | post | 10 | 8.00 | 1.05 | 7.00 | 10.0 |
| | | | foll | 10 | 8.10 | 1.10 | 7.00 | 10.0 |
| | | Control group | pre | 10 | 9.20 | 1.39 | 7.00 | 11.0 |
| | | | mid | 10 | 9.20 | 1.39 | 7.00 | 11.0 |
| | | | post | 10 | 9.20 | 1.39 | 7.00 | 11.0 |
| | | | foll | 10 | 9.10 | 1.37 | 7.00 | 11.0 |
| | Left | Experimental group | pre | 10 | 8.80 | 1.54 | 7.00 | 11.0 |
| | | | mid | 10 | 8.70 | 1.49 | 7.00 | 11.0 |
| | | | post | 10 | 8.00 | 1.05 | 7.00 | 10.0 |
| | | | foll | 10 | 8.00 | 1.05 | 7.00 | 10.0 |
| | | Control group | pre | 10 | 9.20 | 1.39 | 7.00 | 11.0 |
| | | | mid | 10 | 9.20 | 1.39 | 7.00 | 11.0 |
| | | | post | 10 | 9.20 | 1.39 | 7.00 | 11.0 |
| | | | foll | 10 | 9.20 | 1.37 | 7.00 | 11.0 |

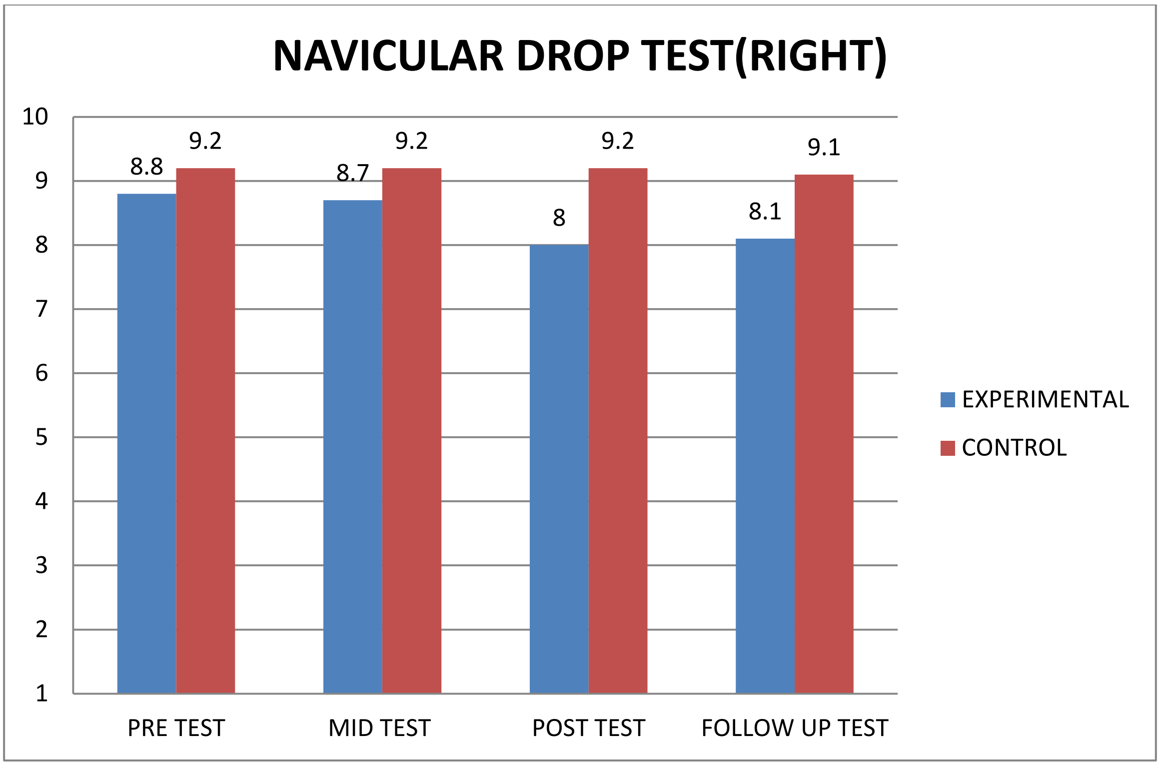
**Table 2**.shows the means and standard deviation scores of a pretest,middletest,posttest,follow up test of the experimental group and control group of chippauxsmirak index and navicular drop test.



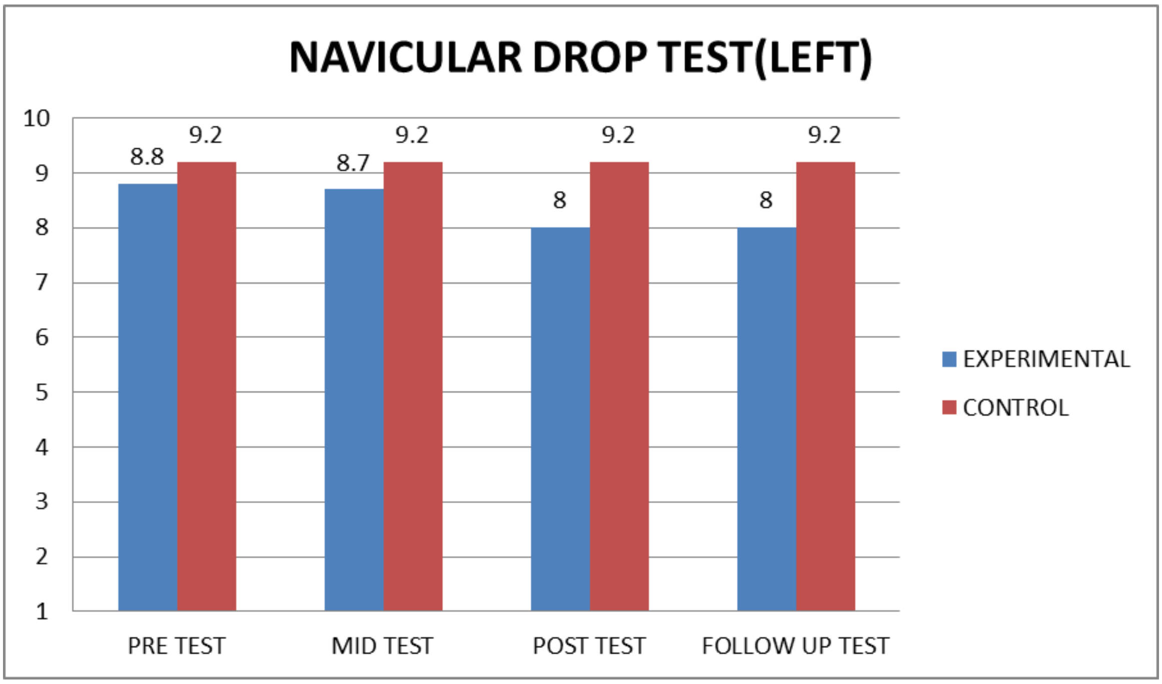

**Graph 1.**shows that the pretest, middle test, posttest, follow up test in experimental group and control group.




**Graph 2.**Shows that the pretest, middle test, posttest, follow up test in experimental group had a mean of 6.63,6.38,6.19,6.19(N=10)and control group had a mean of 6.26,6.24,6.19,6.15(N=10).



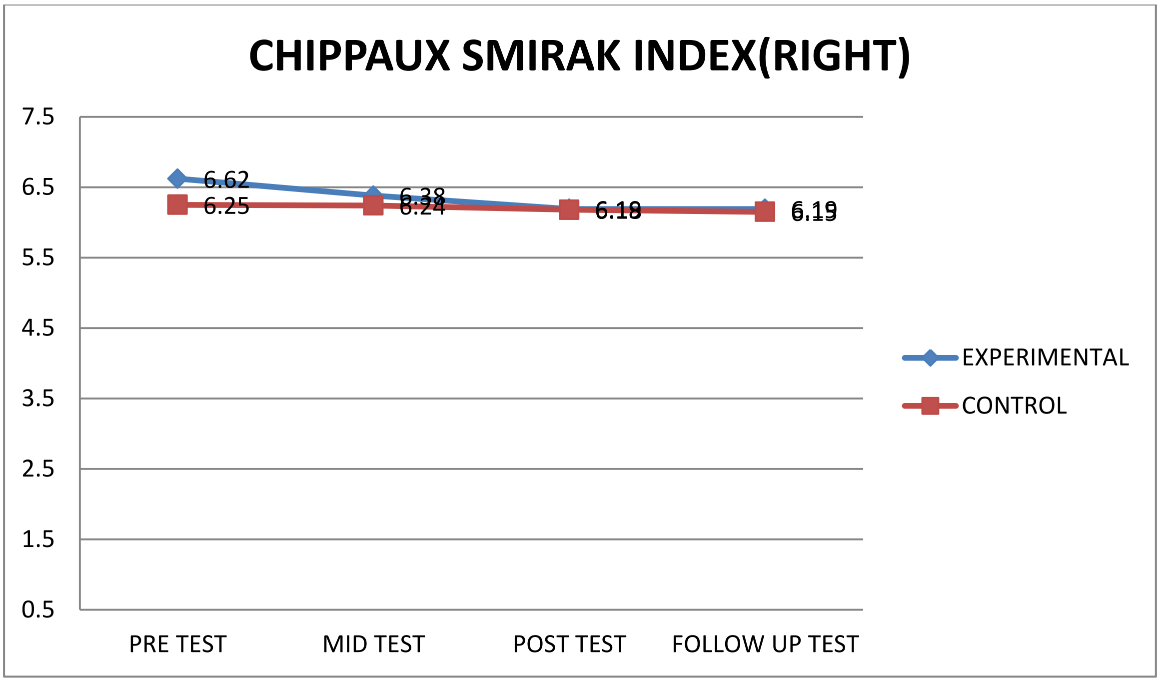

**Graph 3.**Shows that the pretest, middle test, posttest, follow up test in experimental group had a mean of 8.80,8.70,8.00,8.10(N=10)and control group had a mean of 9.20,9.20,9.20,9.10(N=10).




**Graph 4.** Shows that the pretest, middle test, posttest, follow up test in experimental group had a mean of 8.80,8.70,8.00,8.00 (N=10)and control group had a mean of 9.20,9.20,9.20,9.10(N=10).

**Table 3:** Comparison between the experimental and control group of chippauxsmirak index scores of various timeline(between group analysis)

| Scale | test | Group | N | Mean | S.D | Mann-Whitney U | P value |
|---|---|---|---|---|---|---|---|
| Chippauxsmirak index (right) | Pre test | Experimental group | 10 | 6.62 | 0.65 | 33.00 | -1.29 |
| | | Control group | 10 | 6.25 | 0.48 | | |
| | Mid test | Experimental group | 10 | 6.38 | 0.56 | 43.00 | -.531 |
| | | Control group | 10 | 6.24 | 0.47 | | |
| | Post test | Experimental group | 10 | 6.19 | 0.51 | 49.00 | -.076 |
| | | Control group | 10 | 6.18 | 0.50 | | |
| | Follow up | Experimental group | 10 | 6.19 | 0.51 | 48.50 | -.114 |
| | | Control group | 10 | 6.15 | 0.50 | | |
| Chippauxsmirak index (left) | Pre test | Experimental group | 10 | 6.63 | 0.63 | 32.50 | -1.32 |
| | | Control group | 10 | 6.26 | 0.46 | | |
| | Mid test | Experimental group | 10 | 6.38 | 0.56 | 43.00 | -.531 |
| | | Control group | 10 | 6.24 | 0.47 | | |
| | Post test | Experimental group | 10 | 6.19 | 0.47 | 48.50 | -.114 |
| | | Control group | 10 | 6.18 | 0.47 | | |
| | Follow up | Experimental group | 10 | 6.19 | 0.47 | 46.50 | -.266 |
| | | Control group | 10 | 6.15 | 0.46 | | |



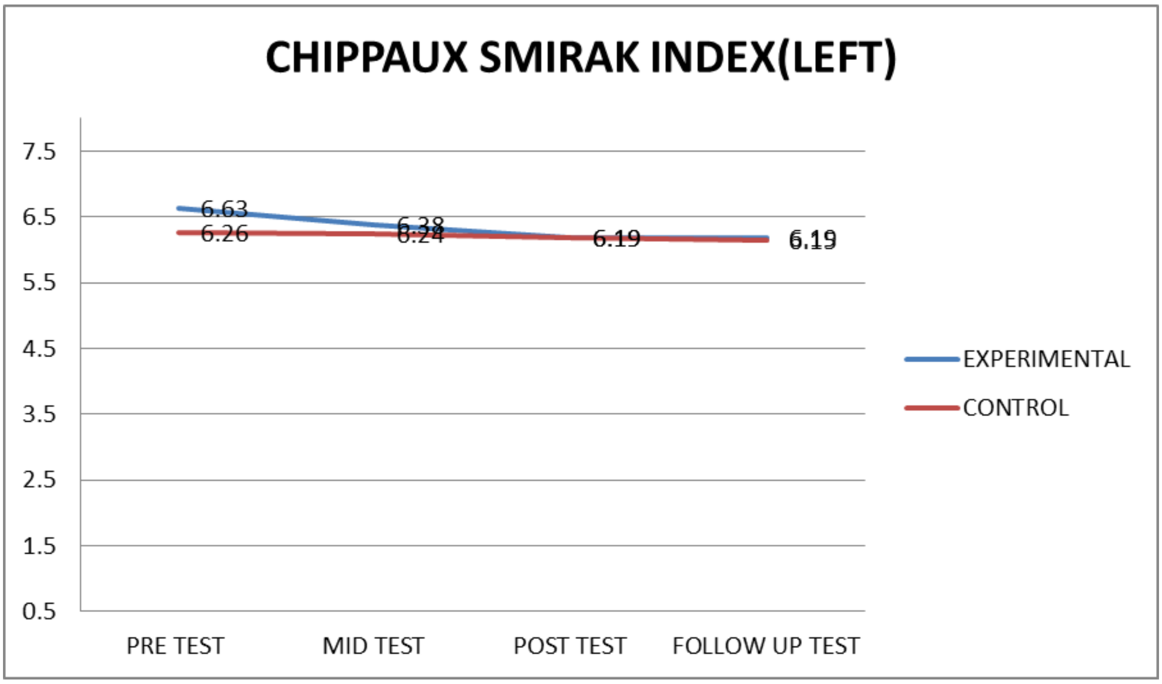
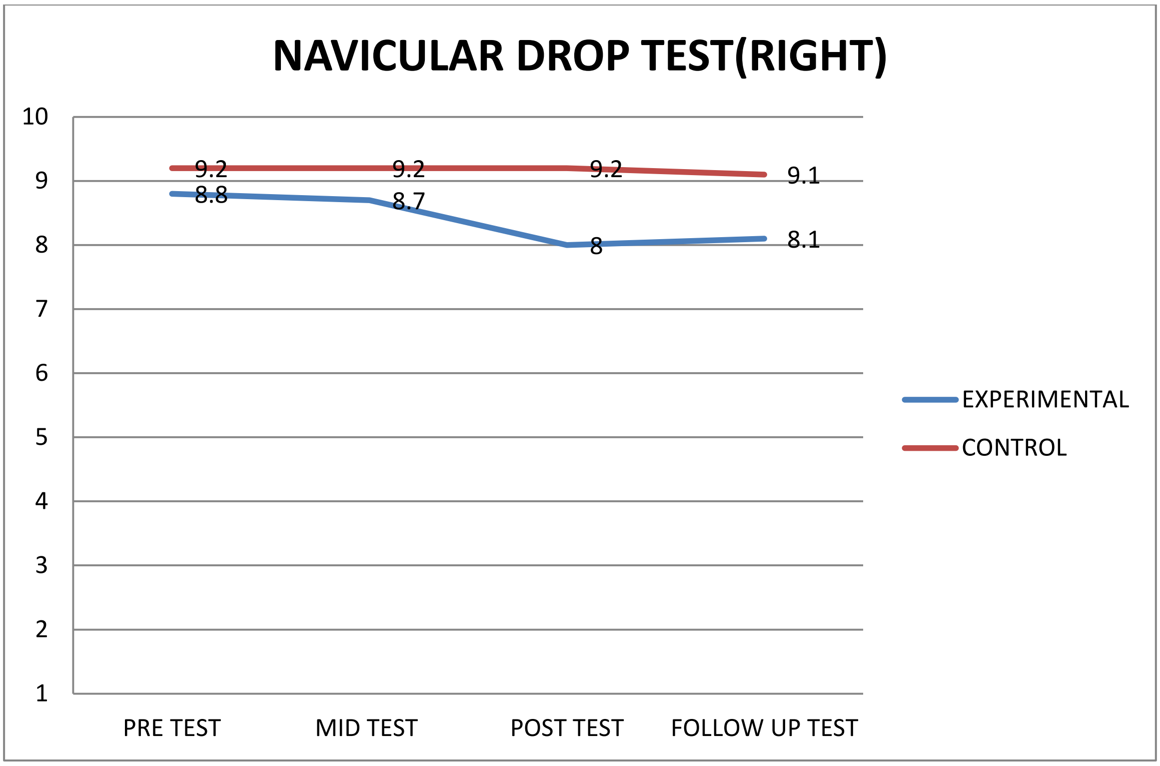




**Table 3**,**Graph 5 and 6**.shows that there is no significant difference ($p>0.05$) in the pretest ,middle test,posttest,follow up test scores of chippauxsmirak test of the experimental group and the pretest,middle test,post test and follow up test scores of chippauxsmirak of the control group

**Table 4**: Comparison between the experimental and control group of navicular drop test scores of various timeline(between group analysis)

| Scale | test | Group | N | Mean | S.D | Mann-Whitney U | P value |
|---|---|---|---|---|---|---|---|
| Navicular drop test (Right) | Pre test | Experimental group | 10 | 8.80 | 1.54 | 41.50 | -.665 |
| | | Control group | 10 | 9.20 | 1.39 | | |
| | Mid test | Experimental group | 10 | 8.70 | 1.49 | 39.50 | -.815 |
| | | Control group | 10 | 9.20 | 1.39 | | |
| | Post test | Experimental group | 10 | 8.08 | 1.05 | 25.00 | -1.94 |
| | | Control group | 10 | 9.20 | 1.39 | | |
| | Follow up | Experimental group | 10 | 8.10 | 1.10 | 29.00 | -1.628 |
| | | Control group | 10 | 9.10 | 1.37 | | |
| Navicular drop test( Left) | Pre test | Experimental group | 10 | 8.80 | 1.54 | 41.50 | -.665 |
| | | Control group | 10 | 9.20 | 1.39 | | |
| | Mid test | Experimental group | 10 | 8.70 | 1.49 | 39.50 | -.815 |
| | | Control group | 10 | 9.20 | 1.39 | | |
| | Post test | Experimental group | 10 | 8.08 | 1.05 | 25.00 | -1.94 |
| | | Control group | 10 | 9.20 | 1.39 | | |
| | Follow up | Experimental group | 10 | 8.00 | 1.05 | 26.50 | -1.825 |
| | | Control group | 10 | 9.10 | 1.37 | | |



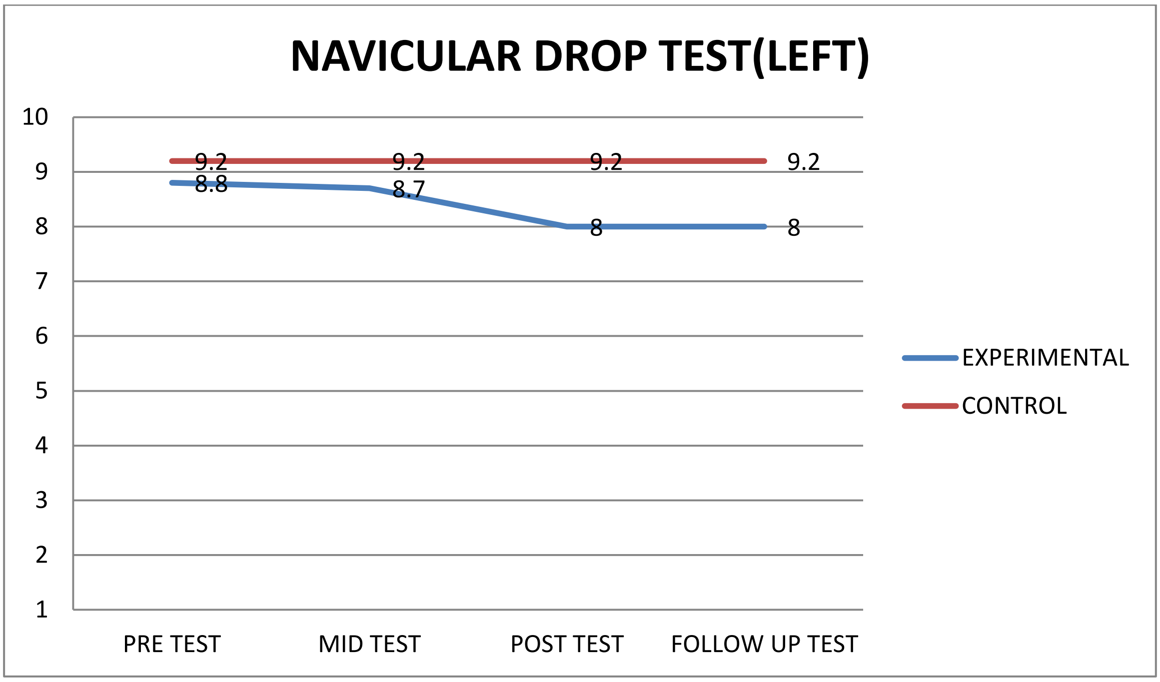




**Table 4,Graph 7 and 8.**shows that there is no significant difference ($p>0.05$) in the pretest ,middle test,posttest,follow up test scores of navicular drop test of the experimental group and the pretest,middle test,post test and follow up test scores of navicular drop test of the control group

**Table 5:** comparison within pretest and middle test,posttest,follow up results of experimental group- wilcoxon

| Scale | Test | outcomes | N | Mean | S.D | Z value | P value |
|---|---|---|---|---|---|---|---|
| Chippauxsmirak index(right) | Pre test | Mid test | 10 | 6.38 | .563 | -2.585 | .010 |
| | | Post test | 10 | 6.19 | .519 | -2.527 | .012 |
| | | Followup test | 10 | 6.19 | .519 | -2.527 | .012 |
| Chippauxsmirak index(left) | Pre test | Mid test | 10 | 6.38 | .563 | -2.716 | .007 |
| | | Post test | 10 | 6.19 | .477 | -2.673 | .008 |
| | | Follow up test | 10 | 6.19 | .477 | -2.673 | .008 |
| Navicular drop test(right) | Pre test | Mid test | 10 | 8.70 | 1.49 | -1.00 | .317 |
| | | Post test | 10 | 8.00 | 1.05 | -2.271 | .023 |
| | | Follow up test | 10 | 8.10 | 1.10 | -2.333 | .020 |
| Navicular drop test(left) | Pre test | Mid test | 10 | 8.70 | 1.49 | -1.00 | .317 |
| | | Post test | 10 | 8.00 | 1.05 | -2.271 | .023 |
| | | Follow up test | 10 | 8.00 | 1.05 | -2.271 | .023 |

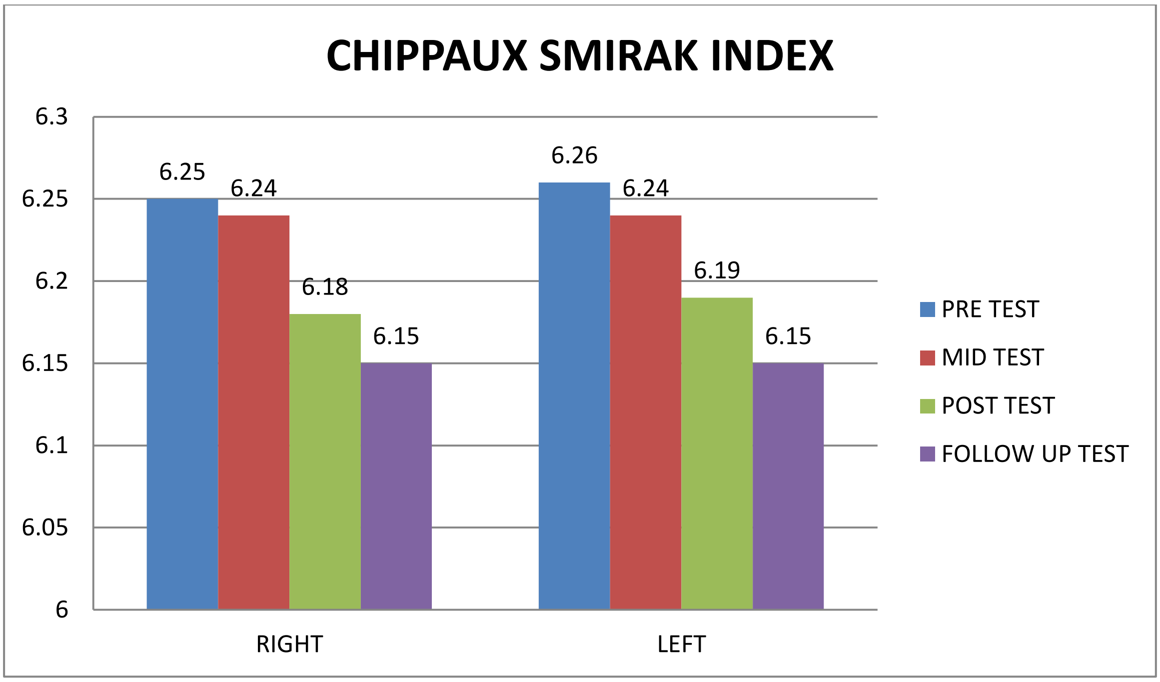



**Table 5. Graph 9** shows the time frame between pretest tomidtest was no statistical significane,but the time frame between midtest to posttest and posttest to follow up test scores within the experimental group on the scales of a chippauxsmirak index showed statistical significance .

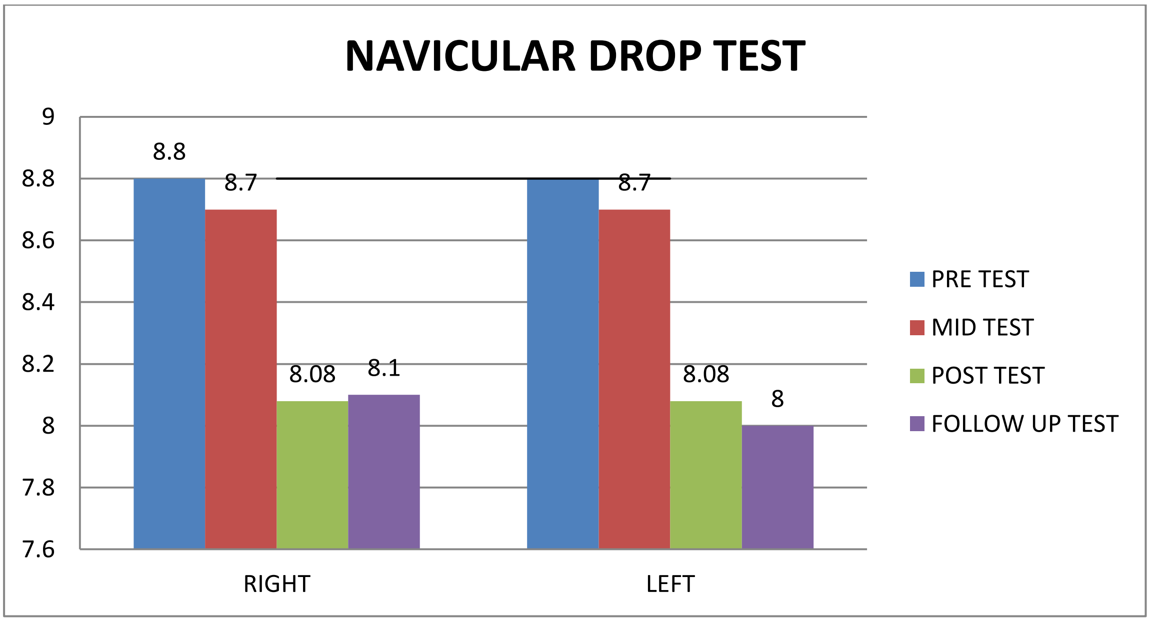



**Table 5. Graph 10**shows the time frame between pretest tomidtest was no statistical significane,but the time frame between midtest to posttest and posttest to follow up test scores within the experimental group on the scales of a chippauxsmirak index showed statistical significance

**Table 6:** comparison within pretest and middle test,posttest,follow up results of control group- wilcoxon

| Scale | Test | outcomes | N | Mean | S.D | Z value | P value |
|---|---|---|---|---|---|---|---|
| Chippuaxsmirak index (right) | Pre test | Mid test | 10 | 6.24 | .478 | -1.00 | .317 |
| | | Post test | 10 | 6.18 | .507 | -1.890 | .059 |
| | | Followup test | 10 | 6.15 | .506 | -1.826 | .068 |
| Chippauxsmirak index (left) | Pre test | Mid test | 10 | 6.24 | .478 | -1.414 | .157 |
| | | Post test | 10 | 6.19 | .472 | -2.070 | .038 |
| | | Follow up test | 10 | 6.15 | .467 | -2.414 | .016 |
| Navicular drop test (right) | Pre test | Mid test | 10 | 9.20 | 1.39 | .000 | 1.000 |
| | | Post test | 10 | 9.20 | 1.39 | .000 | 1.000 |
| | | Follow up test | 10 | 9.10 | 1.37 | -1.00 | .317 |
| Navicular drop test (left) | Pre test | Mid test | 10 | 9.20 | 1.39 | .000 | 1.000 |
| | | Post test | 10 | 9.20 | 1.39 | .000 | 1.000 |
| | | Follow up test | 10 | 9.10 | 1.37 | -1.00 | .317 |

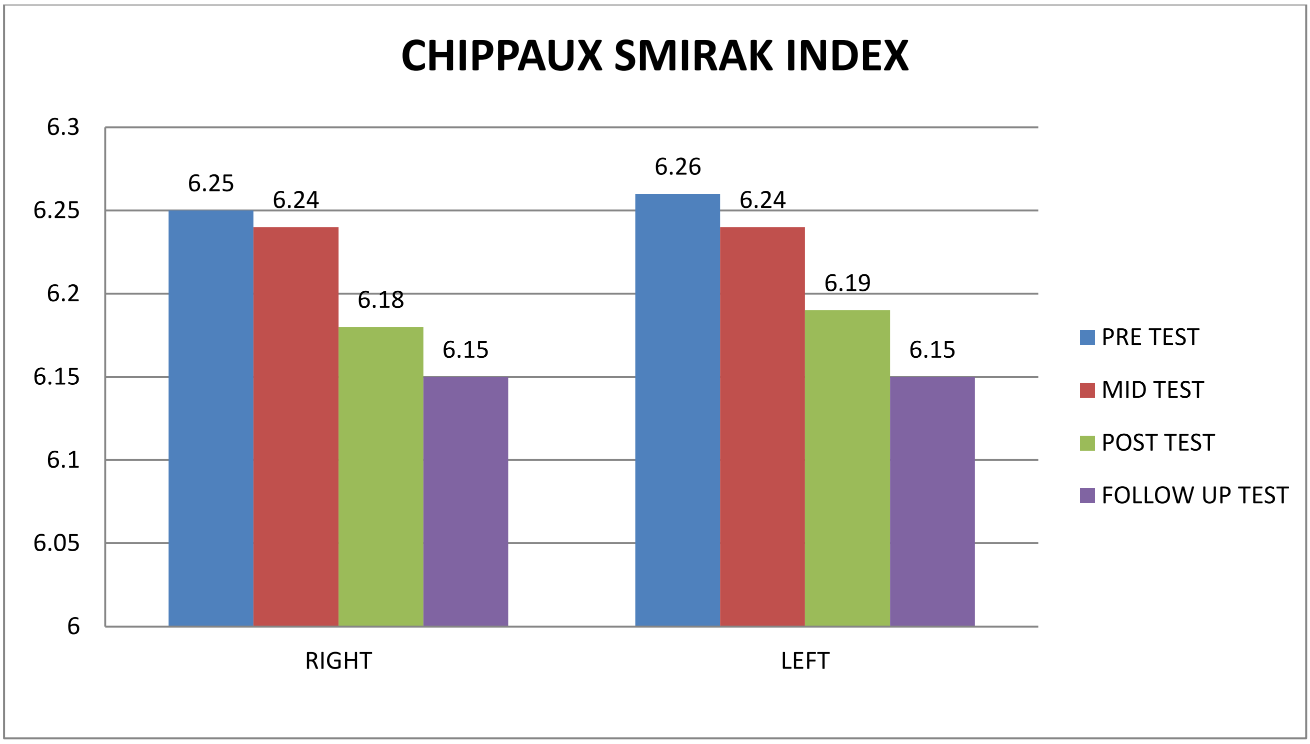



**Table 6. Graph 11** shows the time frame between pretest to midtest was no statistical significane,but the time frame between pretest to posttest and pretest to follow up test scores within the experimental group on the scales of a chippauxsmirak index showed statistical significance **.**

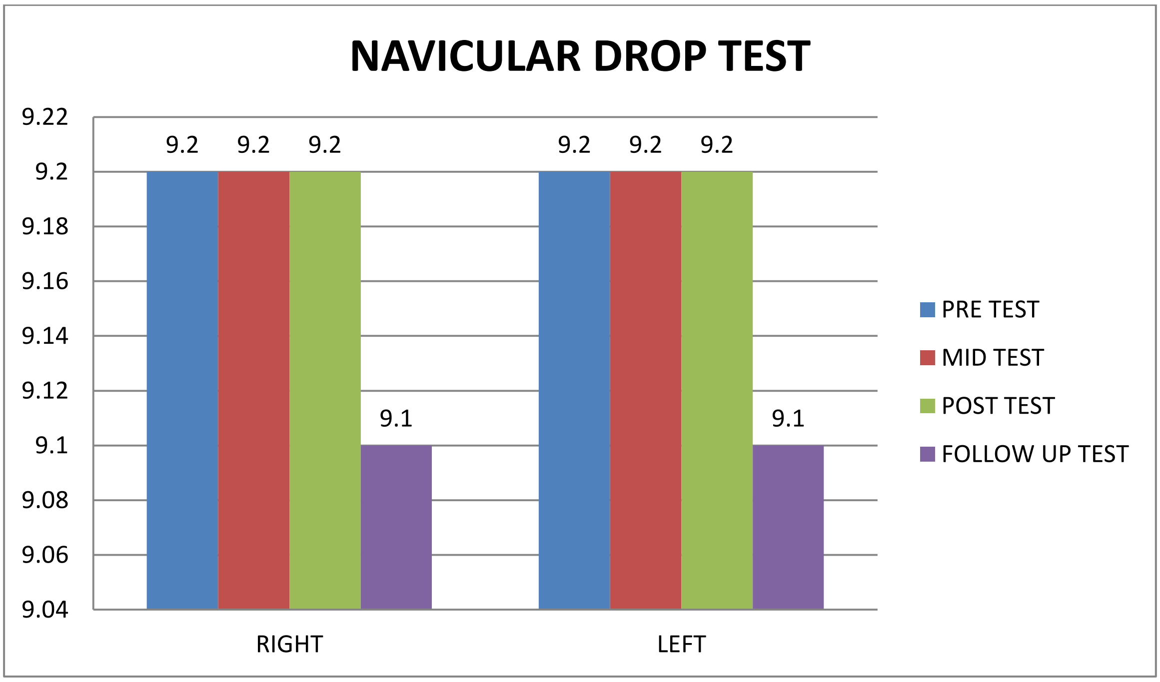



**Table 6. Graph 12** shows the time frame between pretest tomidtest,posttestand follow up test scores within the experimental group on the scales of a navicular drop test showed no statistical significant difference.

**Table 7**:The effect size of chippauxsmirak index of experimental group

| Measure | df | Mean square | F | Sig. | Partial eta sqared |
|---|---|---|---|---|---|
| Chippauxsmirak index (Right) | 1.161 | 1.076 | 21.371 | .001 | .704 |

The above table shows that the repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean of chippauxsmirak index was statistically significantly between time points ($F(1.161,10.446) = 21.371$, $P < 0.0005$)**.**

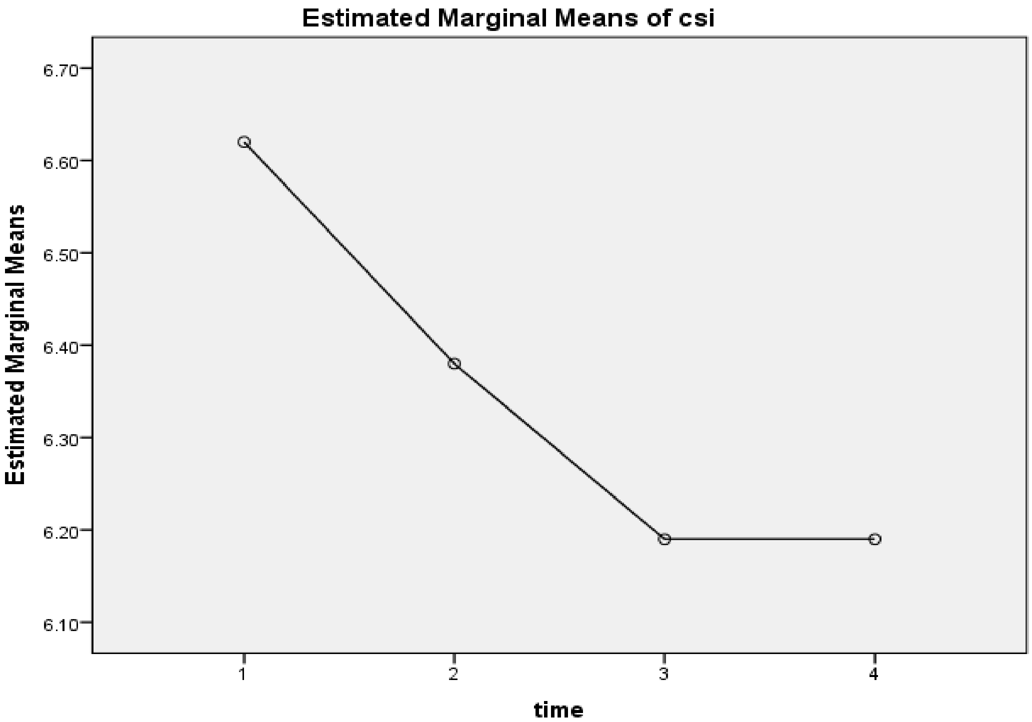


**Table 8**:The effect size of chippauxsmirak index of experimental group

| Measure | df | Mean square | F | Sig. | Partial eta sqared |
|---|---|---|---|---|---|
| Chippauxsmirak index(left) | 1.193 | 1.094 | 26.226 | .000 | .745 |

The above table shows that the repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean ofchippauxsmirak index was statistically significantly between time points (F(1.193,10.734) = 26.226, P < 0.05).

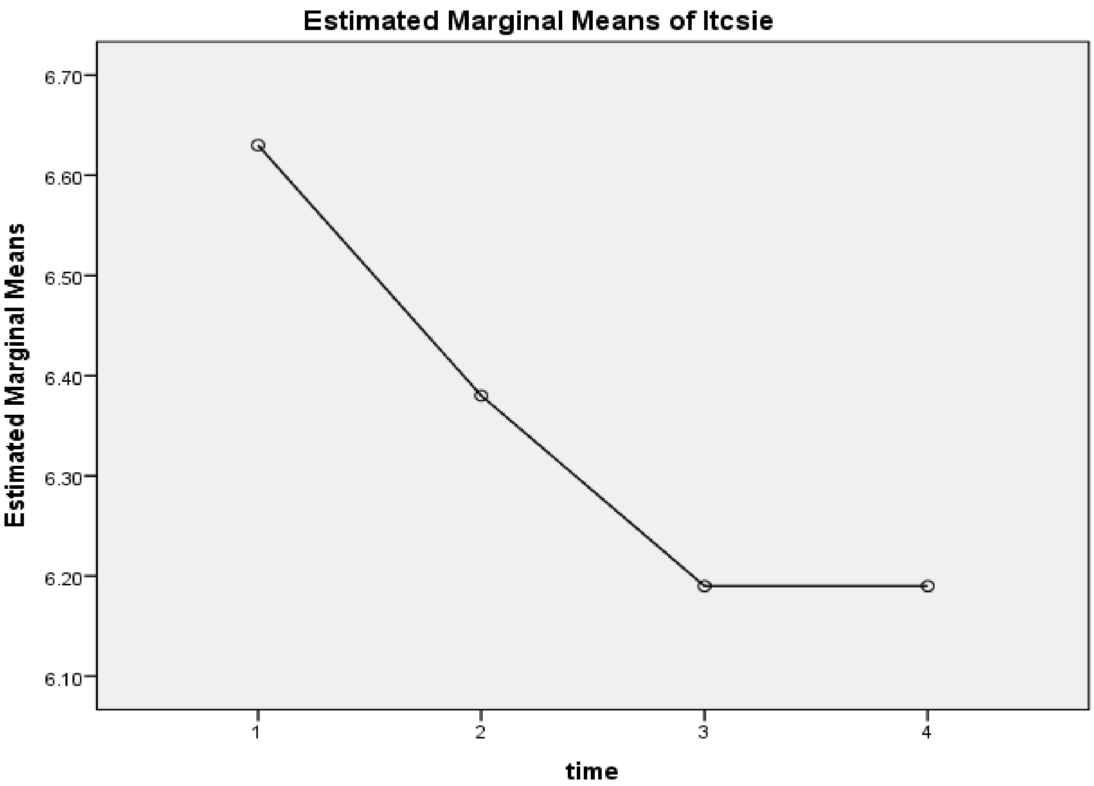


**Table 9:** The effect size of navicular drop test of experimental group

| Measure | df | Mean square | F | Sig. | Partial eta sqared |
|---|---|---|---|---|---|
| Navicular drop test (right) | 1.404 | 3.560 | 9.00 | .007 | .500 |

The above table shows that the repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean of navicular drop testwas statisticallysignificant between time points ($F(1.404,12.640) = 9.00$, $P < 0.05$).

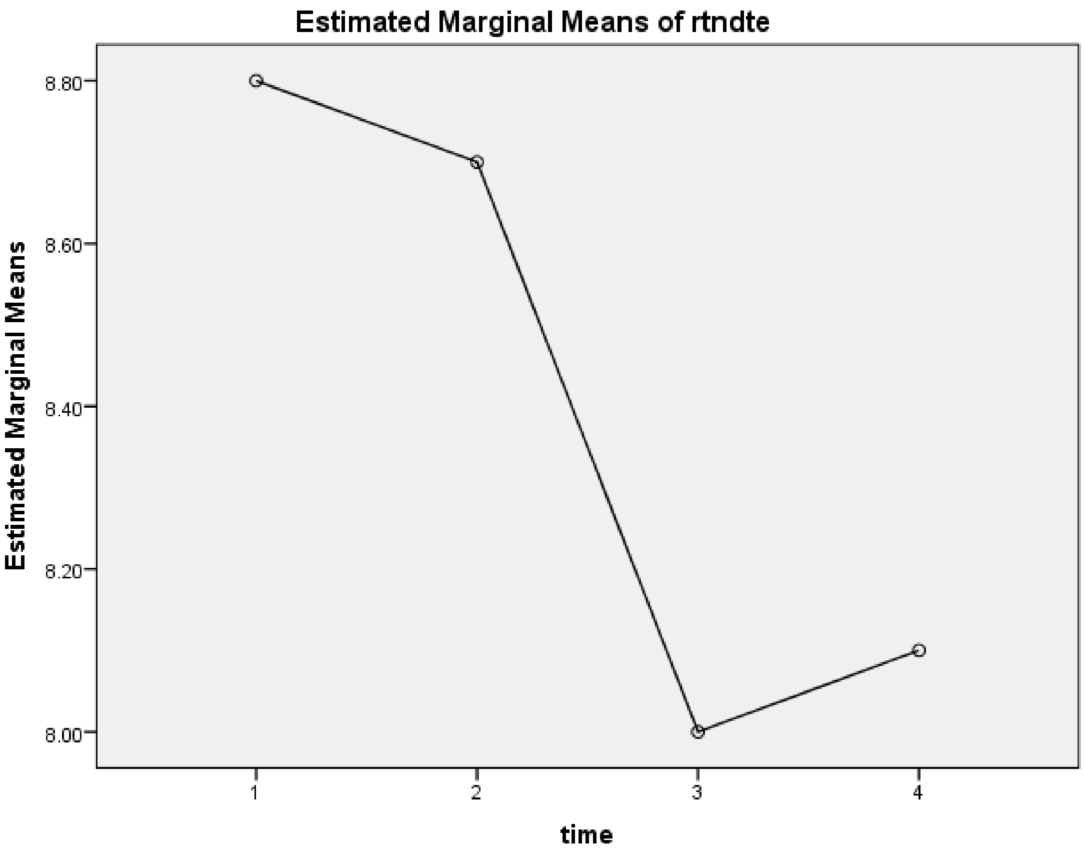


**Table 10:**The effect size of navicular drop test of experimentalgroup

| Measure | df | Mean square | F | Sig. | Partial eta sqared |
|---|---|---|---|---|---|
| Navicular drop test (left) | 1.162 | 4.882 | 10.06 | .008 | .528 |

The above table shows that the repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean navicular drop test statistically significant between time points ($F(1.162,10.462) = 10.06$, $P < 0.05$).

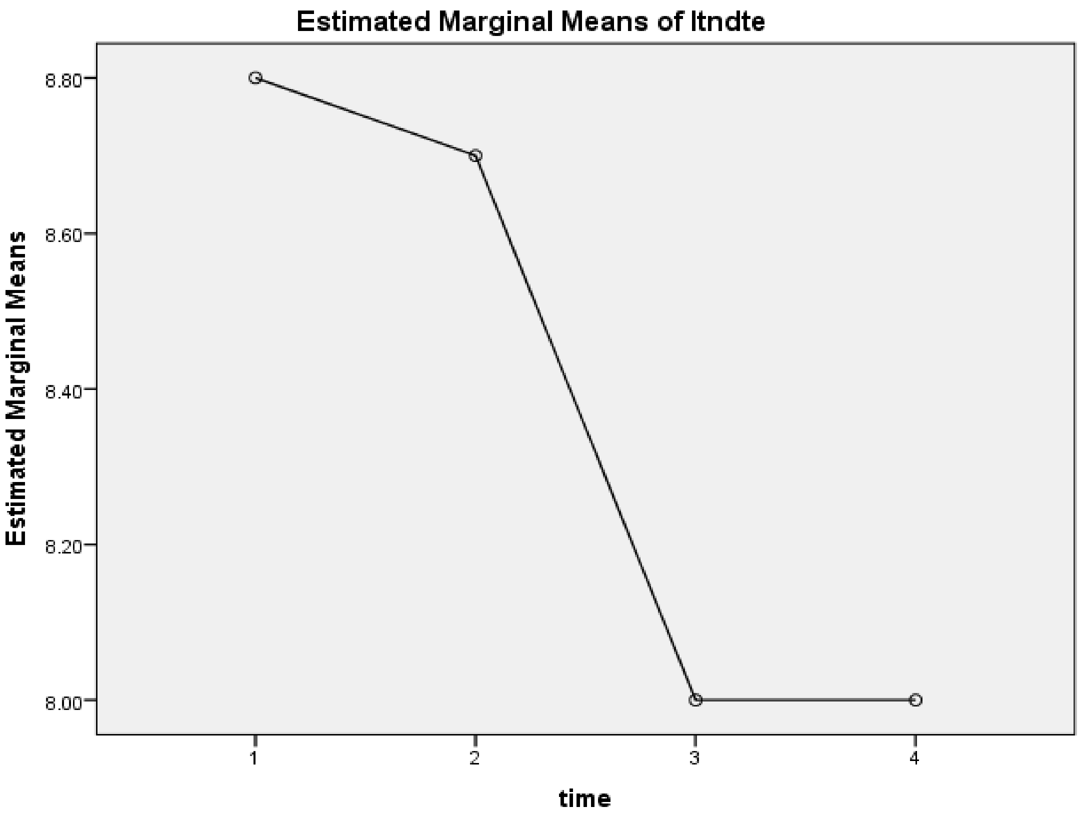


**Table 11**:The effect size of chippauxsmirak index of control group

| Measure | df | Mean square | F | Sig. | Partial eta sqared |
|---|---|---|---|---|---|
| Chippauxsmirak index (right) | 1.141 | .060 | 3.981 | .070 | .307 |

The above table shows that the repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean chippauxsmirak index statistically significant between time points ($F(1.141,10.265) = 3.981$, $P < 0.05$).

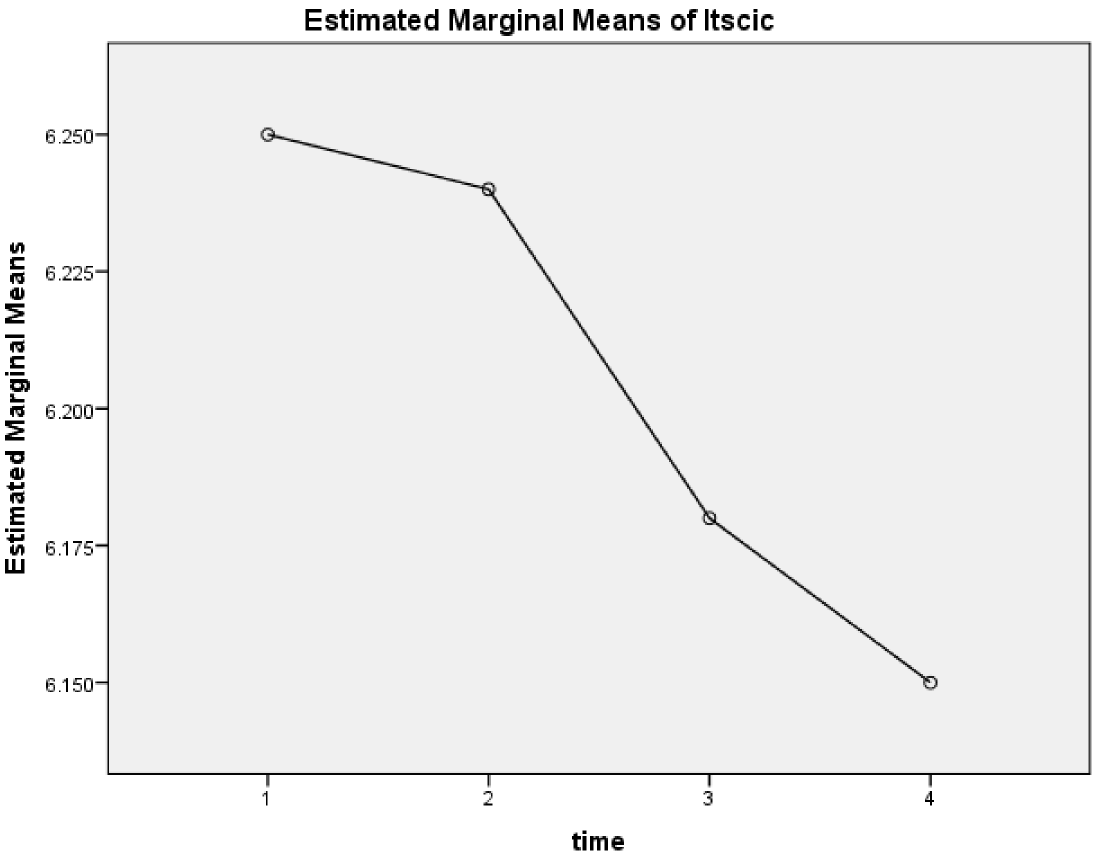


**Table 12**:The effect size of chippauxsmirak index of control group

| Measure | df | Mean square | F | Sig. | Partial eta sqared |
|---|---|---|---|---|---|
| Chippauxsmirak index (left) | 1.525 | .049 | 8.222 | .007 | .477 |

The above table shows that the repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean of chippauxsmirak index statistically significant between time points ($F(1.525,13.729) = 8.222$, $P < 0.05$).

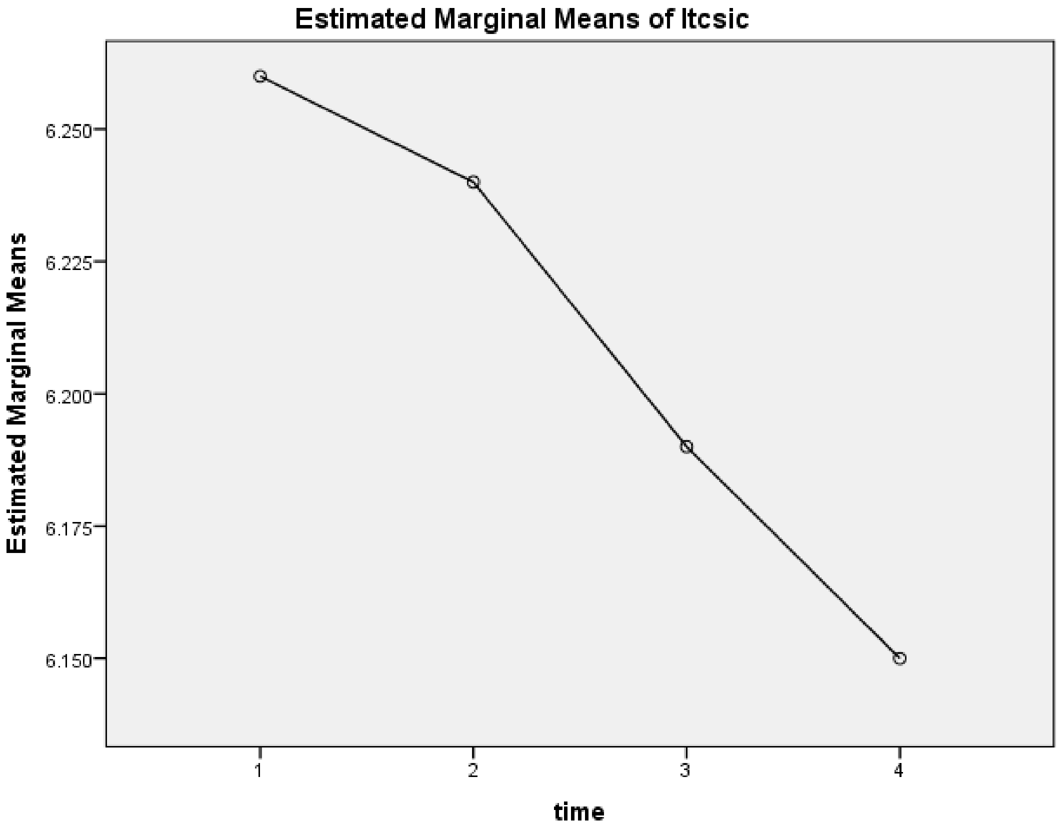


**Table 13**:To examine the effect size of navicular drop test of control group

| Measure | df | Mean square | F | Sig. | Partial eta sqared |
|---|---|---|---|---|---|
| Navicular drop test (right) | 1.000 | .075 | 1.000 | .343 | .100 |

The above table shows that the repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean of navicular drop test statistically insignificant between time points (1.000,9.00) = 1.000, P > 0.05).

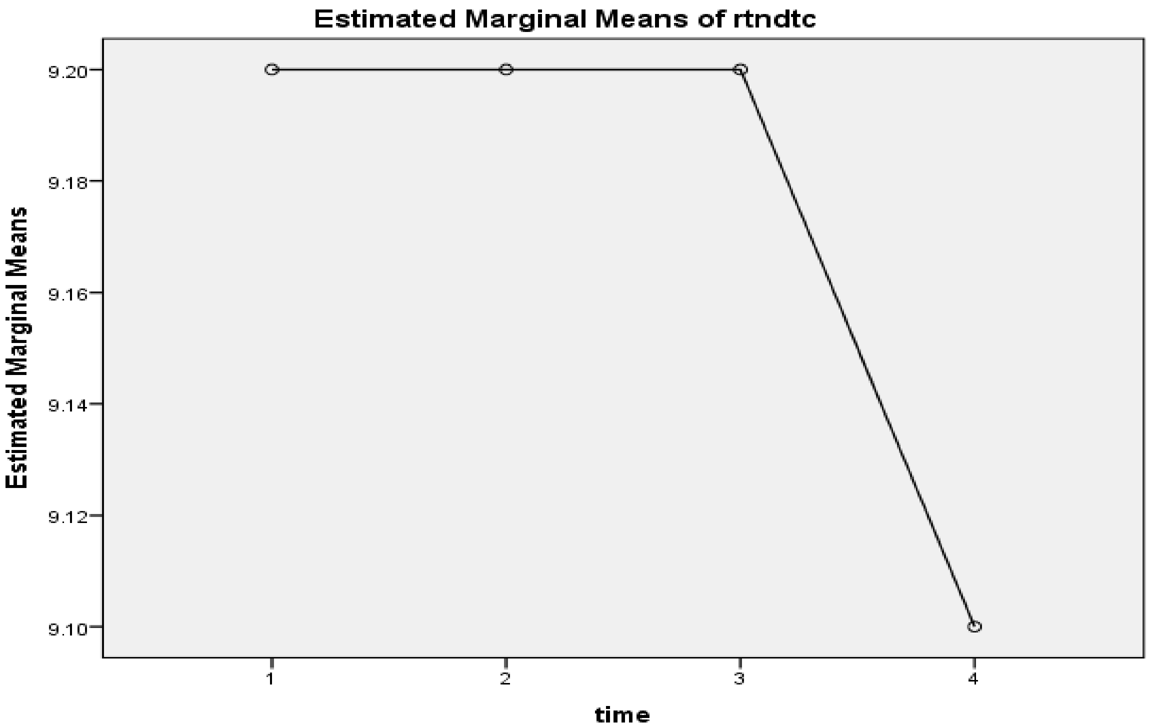
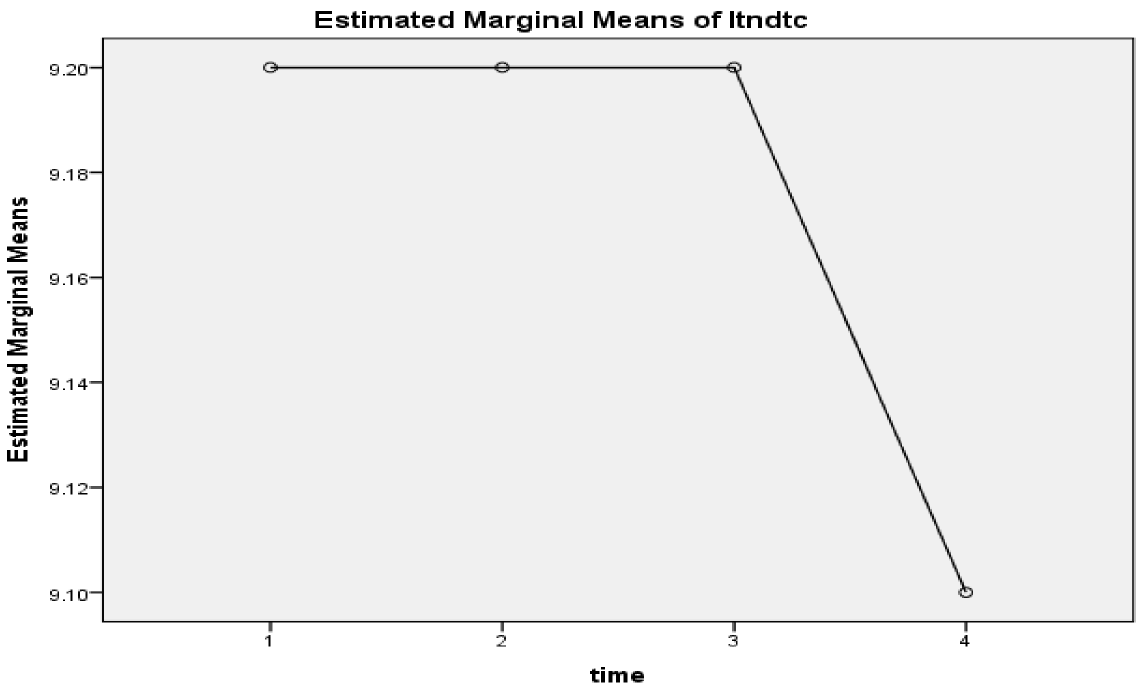


**Table 14**:To examine the effect size of navicular drop test of control group

| Measure | df | Mean square | F | Sig. | Partial eta sqared |
|---|---|---|---|---|---|
| Navicular drop test (left) | 1.000 | .075 | 1.000 | .343 | .100 |

The above table shows that the repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean of navicular drop test statistically insignificant between time points (1.000,9.00) = 1.000, P > 0.05).



# DISCUSSION

This study was done to find out the short term effect of kinesiotaping in improving medial arch of children with flexible flatfoot. There is a lack of sufficient literature showing effectiveness of kinesiotapingin the preschool aged children.Orthotic treatment should only be considered after the age of 3.Since 1-3 represent a holding period during which no specific treatment is needed, other than a firm supportive arch support[34].Therefore this study recruited children in the age group of 3 to 6 years and also emphasized on finding its effect within a minimum duration of 4 weeks.

***Participant Characteristics***

This study involved 20 children with flexible flat foot who were randomly assigned into the experimental and control group. There were 10 boys in experimental group and 8 boys and 2 girls in the control group. The mean age of children in the experimental group was 4.27 ±0.843 and that of control group was 0.461±0.732 (**Table 1**).

***Effectiveness of Kinesiotaping and sandals with custom made medial arch support***

**Table 2** shows that the mean values of **CSI** for the **right foot in experimental group** was 6.62±0.65 (pretest), 6.38±0.56 (midtest), 6.19±0.51(posttest), 6.19±0.51(followup) and for **left foot in experimental group** was 6.63±0.63 (pretest), 6.38±0.56 (midtest), 6.19±0.47 (posttest), 6.19±0.47(follow up). This shows that there was improvement between pre intervention, mid and post intervention . But there was no change between posttest and follow up period .The mean values of CSI for **right foot in control group** was 6.25±0.48 (pretest), 6.24±0.47 (midtest), 6.18±0.50 (posttest), 6.15±0.50(follow up) and values for **left foot in control group** was 6.26±0.46 (pretest), 6.24±0.47 (midtest), 6.19±0.47 (posttest), 6.15±0.46 (follow up) . Based on the mean values of CSI children in both the kinesiotaping and custom made medial arch support group showed an increase in the medial arch for both the foot consistently from pre intervention to follow up period .

**ND test** for **right foot in experimental group** are 8.80±1.54 (pretest),8.70±1.49 (mid test), 8.00±1.05 (post test), 8.10±1.10 (follow up) and values for **left foot in experimental group** was 8.80±1.54 (pretest), 8.70±1.49 (midtest), 8.00±1.05 (posttest), 8.00±1.05 (follow up). The values of **right foot in control group** was 9.20±1.39 (pretest), 9.20±1.39(midtest), 9.20±1.39(posttest), 9.10±1.37 (follow up) and the values of **left foot in control group** was

9.20±1.39 (pretest), 9.20±1.39(midtest), 9.20±1.39(posttest), 9.10±1.37 (follow up).Navicular drop mean scores didn't shows much changes on the timelines from pre intervention to follow up phase .For both kinesiotaping and sandals with custom made medial arch support group. In this ND test was used that has a high reliability as found in the study done by KaynooshHomayouni et al. It was emphasized that visual assessment of the arch height is unreliable because the amount of fat mass may mislead the clinician to evaluate the foot as flatfoot. Using easily identifiable bony landmarks such as navicular bone increases the reproducibility and may provide a better indication of typical foot function during walking [21]. Chippaux-Smirakindex (CSI) were employed to measure flatness of the footprint [2].

On comparing the pretest scores of CSI and NDT of experimental and control group on baseline, the values were not statistically significant showing that both the groups were homogenous in characteristics and could be considered for further statistical analysis. (**Tables3 and4**)**This finding is congruent with the results of the study [5] by Vadivelan K et al. where there is no statistically significant difference between the groups in the ND test scores during post test**.

On comparison of scores of CSI and NDT between experimental and control at the various time lines from pre to follow up period there was no statistical significant (**table 4**). This shows that though there was no statistical significant in both the groups,but the mean values showed a change at the various time lines. This findings is congruent with the study done by Luque-Suarez et al were in they found that kinesiotaping has no effect on pronated foot[24]. The other study done by samiha et al in children with down syndrome with flatfoot they found that there was no significant difference in gait parameters between the taping group and medical shoe with medial arch support group[26]

**Seung-Min Lee,etal.**Compared the effect of elastic and non elastic tape on flatfoot and found that non elastic taping showed better effectiveness in flatfoot with normal young adults persons[27]**.**

The study further showed that there was no significant difference between the right and left foot for both the groups on CSI and NDT scores as shown in **Table 4**. The values for right foot are p= -0.655( pretest ), p= -0.815(midtest), p= -1.94 (posttest),p= -1.628 (follow up). The scores for left foot are p= -0.665( pretest ), p= -0.815(midtest), p= -1.94(posttest), p= -1.825 (follow up).

Whereas the kinesiotaping group showed statistically significant($p<.05$) improvement in CSI scores,but not NDT scores at the various timelines. For NDT mid test scores were not statistically significant (**Table 5**). These findings are similar to the results of the **study [5] by Vadivelan K et al. where there is a statistically significant difference within the kinesiotaping group in the ND test values.**

There was no statistically significant difference ($p>0.5$) in scores of CSI and ND test at various time lines for the arch support groups (**table 6**). **These findings are similar to the results of the study[23] by Evans AM et al., which states that custom made arches are effective for flat foot only when it is used for a longer duration of time.**

The current study demonstrated a **medium effect size** in experimental CSI scores (– right foot -$\eta p2=0.704$ ; left foot - $\eta p2=0.745$ ) and **a small effect size** in the control group CSI scores –(right foot- $\eta p2=0.307$; left foot - $\eta p2 =0.477$).

The experimental group showed **medium effect size**on ND test results( right foot ($\eta p2=0.500$) and left foot ($\eta p2=0.528$) and a **small effect size** of control group ND test scores right foot ($\eta p2=0.100$) and left foot($\eta p2=0.100$).

The findings of this study conclude that there is no statistically significant difference when the intervention methods of kinesiotaping and custom made foot arch were compared but kinesiotaping was found to be effective and statistically significant when considered within the group, as the experimental group of children showed significant improvement in the CSI and ND test scores . A study done by Evans et al[23] found that there is no evidence of immediate effect of orthoses or orthopaedic footwear on radiographic parameters of foot posture in children with flatfoot but there are some improvements overtime[23] this correlate with findings of custom made medial arch.

This means that kinesiotape ,when applied for a shorter duration ie., 4 weeks was effective in reducing flexible flatfoot thus it can be used an alternative for custom made foot arch which required a longer duration( 3 years) for showing effectiveness[23].

Results of the present study show that kinesiotaping and sandals with custom made medial arch support were both effective in reducing the flexible flat foot on measuring medial longitudinal arch and foot pronation[28].Arch supports reduce pronation and provide more stability of the foot via holding into a more rigid posture.Besides,arch supports might provide an alternative somatosensory input from sole of the foot,which might aid foot stability and overall body balance,thus aids wider steps,strides,higher velocities and narrower base of support[25.]

These results are supported by previous studies that explained effects of medial shoes and foot taping separately.A number of studies believe that the medical shoe is most appropriately used for the flexible flat foot children[29] and found that medial support in a shoe may provide increased stability to foot and leg and may reduce the maximal foot pronation[30]. Likewise, existing evidence suggested that taping reduces pronation,as indicated by shifts in midfoot pressure from medial to lateral ,as well as changes in forefoot and hind foot forces [31,32]Also taping stiffen the ankle joint and limits the hypermobility and improve the gait patterns[33]

# CONCLUSION

Both foot taping and medial shoe were found equally beneficial in reducing flexible flat foot in children .Currently, our best clinical suggestion based on these results is the alternative use of both supportive methods, in a way to achieve benefits and avoid possible drawbacks of each.

# LIMITATIONS AND RECOMMENDATIONS

## Limitations

- Dynamic analysis was not done in order to measure actual bony displacement during gait.
- Computerized 3D evaluation method to measure the changes in foot kinematics.
- No additional method of kinesiotape was utilized to reinforce the usual method of stabilizing the flexible flat foot.

## Recommendations

- More precise computerized 3D analysis method can be utilized to derive accurate change.
- Analysis of kinesiotape effectiveness during dynamic gait can be added.
- Taping for the muscles of medial longitudinal arch (Tibialis anterior, tibialis posterior, flexor digitorum longus, flexorhallucis longus) can be added.
- The study can be done in children with specific diagnosis.
- Longterm follow up  rather than 15 days of follow up.
- Other taping methods can be used.

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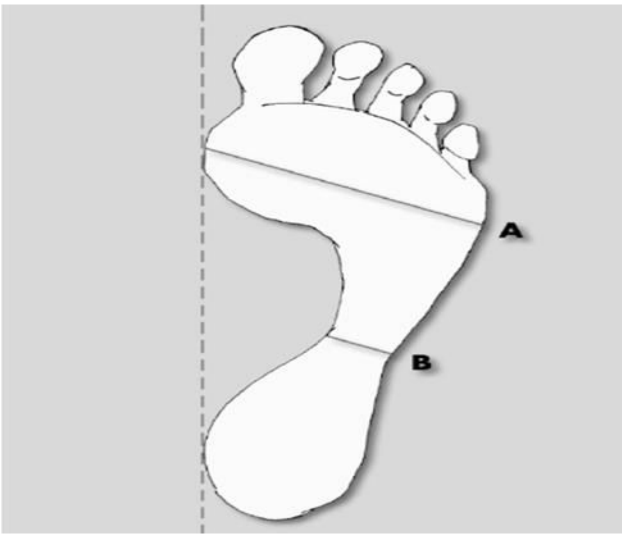
CHIPPAUX SMIRAK INDEX




CSI as described by Forriol and Pascual was used to collect the anthropometric measures of the feet and to analyze the medial longitudinal arch. To calculate this index, two tangents were drawn: one through the most medial points and another through the most lateral points of the regions of the metatarsal heads and calcaneus. Next, two parallel straight lines were drawn: the first between the most medial and the most lateral points of metatarsal head region, thus obtaining the widest section of the impression (segment a); and the second over the narrowest section of the medial longitudinal arch (segment b). Both segments were measured, and the value of b was divided by a. For this index, the reference values were: 0 cm - cavus foot; 0.01 to 0.29 cm - normal foot; 0.30 to 0.39 cm - intermediate foot; 0.40 to 0.44 cm - lowered foot; and 0.45 cm or more - flat foot .The chippauxsmirak index had excellent inter-rater reliability ICC:0.98 and test retest reliability ICC:0.97

NAVICULAR DROP TEST

The navicular drop test first described by Brody in 1982 as a means of quantifying the amount of foot pronation in runners.Thenavicular drop test was performed by calculating the difference in height of the navicular from the floor when the sub talar joint was positioned in neutral and in a full weight bearing position.An navicular drop of 6-9 mm was considered being within the normal range and an navicular drop of >10mm was considered as abnormal result**.**

**Reliability:**

Vauhnik et al., (2006) reported a moderate to good intra-reliability of the ND test. Mean values of 0.5 cm in ND for right foot and 0.6 cm in ND for left foot were found, with intraclass correlation coefficients of 0.78 for the right leg and 0.88 for the left leg. Mueller et al., (1993) reported good intrarater reliability. Sell et al. (1994) found good intrarater and interrater reliability. They evaluated the reliability of measuring ND in 30 healthy subjects and reported a mean value of 0.6 cm in ND. Intraclass correlation coefficient for intra and inter-rater reliability were found to be 0.73 and 0.83.

Master chart 1

| | PRETEST | | MID TEST | | POST TEST | | FOLLOW UP | |
|---|---|---|---|---|---|---|---|---|
| EXPERIMENTAL GROUP (RIGHT) | CSI | NDT | CSI | NDT | CSI | NDT | CSI | NDT |
| 1 | 0.75cm | 10mm | 0.72cm | 10mm | 0.70cm | 9mm | 0.70cm | 9mm |
| 2 | 0.65cm | 8mm | 0.63cm | 8mm | 0.62cm | 8mm | 0.62cm | 8mm |
| 3 | 0.63cm | 7mm | 0.62cm | 7mm | 0.60cm | 7mm | 0.60cm | 7mm |
| 4 | 0.72cm | 11mm | 0.69cm | 11mm | 0.68cm | 10mm | 0.68cm | 10mm |
| 5 | 0.68cm | 10mm | 0.65cm | 10mm | 0.61cm | 8mm | 0.61cm | 8mm |
| 6 | 0.75cm | 10mm | 0.72cm | 10mm | 0.68cm | 9mm | 0.68cm | 9mm |
| 7 | 0.68cm | 10mm | 0.62cm | 9mm | 0.60cm | 8mm | 0.60cm | 9mm |
| 8 | 0.59cm | 7mm | 0.59cm | 7mm | 0.59cm | 7mm | 0.59cm | 7mm |
| 9 | 0.57cm | 7mm | 0.57cm | 9mm | 0.57cm | 7mm | 0.57cm | 7mm |
| 10 | 0.60cm | 8mm | 0.51cm | 8mm | 0.54cm | 7mm | 0.54cm | 7mm |

Master chart 2

| | PRETEST | | MID TEST | | POST TEST | | FOLLOW UP | |
|---|---|---|---|---|---|---|---|---|
| EXPERIMENTAL GROUP ( LEFT) | CSI | NDT | CSI | NDT | CSI | NDT | CSI | NDT |
| 1 | 0.75cm | 10mm | 0.72cm | 10mm | 0.70cm | 9 mm | 0.70 cm | 9 mm |
| 2 | 0.65cm | 8mm | 0.63cm | 8mm | 0.61cm | 8 mm | 0.61 cm | 8 mm |
| 3 | 0.63cm | 7mm | 0.62cm | 7mm | 0.60cm | 7 mm | 0.60 cm | 7 mm |
| 4 | 0.72cm | 11mm | 0.69cm | 11mm | 0.67cm | 10 mm | 0.67 cm | 1 mm |
| 5 | 0.63cm | 10mm | 0.65cm | 10mm | 0.61cm | 8 mm | 0.61cm | 8 mm |
| 6 | 0.75cm | 10mm | 0.72cm | 10mm | 0.68cm | 9 mm | 0.68cm | 9 mm |
| 7 | 0.65cm | 10mm | 0.62cm | 9mm | 0.60cm | 8 mm | 0.60cm | 8 mm |
| 8 | 0.59cm | 7mm | 0.59cm | 7mm | 0.59cm | 7 mm | 0.59cm | 7 mm |
| 9 | 0.58cm | 7mm | 0.57cm | 7mm | 0.57cm | 7 mm | 0.57cm | 7 mm |
| 10 | 0.60cm | 8mm | 0.57cm | 8mm | 0.56cm | 7 mm | 0.56cm | 7 mm |

Master chart 3

| | PRETEST | | MID TEST | | POSTTEST | | FOLLOW UP | |
|---|---|---|---|---|---|---|---|---|
| CONTROL GROUP ( RIGHT) | CSI | NDT | CSI | NDT | CSI | NDT | CSI | NDT |
| 1 | 0.64cm | 8mm | 0.63cm | 8mm | 0.62cm | 8mm | 0.62cm | 8mm |
| 2 | 0.57cm | 8mm | 0.56cm | 8mm | 0.56cm | 8mm | 0.56cm | 8mm |
| 3 | 0.64cm | 10mm | 0.60cm | 10mm | 0.59cm | 10mm | 0.58cm | 10mm |
| 4 | 0.68cm | 11mm | 0.65cm | 11mm | 0.68cm | 11mm | 0.68cm | 11mm |
| 5 | 0.70cm | 11mm | 0.70cm | 11mm | 0.70cm | 11mm | 0.69cm | 11mm |
| 6 | 0.57cm | 7mm | 0.57cm | 7mm | 0.57cm | 7mm | 0.56cm | 7mm |
| 7 | 0.64cm | 10mm | 0.64cm | 10mm | 0.64cm | 10mm | 0.64cm | 10mm |
| 8 | 0.60cm | 8mm | 0.60cm | 8mm | 0.59cm | 8mm | 0.59cm | 8mm |
| 9 | 0.59cm | 9mm | 0.59cm | 9mm | 0.59cm | 9mm | 0.59cm | 9mm |
| 10 | 0.67cm | 10mm | 0.67cm | 10mm | 0.65cm | 10mm | 0.64cm | 10mm |

Master chart 4

| | PRETEST | | MID TEST | | POSTTEST | | FOLLOW UP | |
|---|---|---|---|---|---|---|---|---|
| CONTROL GROUP (LEFT) | CSI | NDT | CSI | NDT | CSI | NDT | CSI | NDT |
| 1. | 0.64 cm | 8 mm | 0.63 cm | 8 mm | 0.63 cm | 8 mm | 0.63cm | 8 mm |
| 2. | 0.56 cm | 8 mm | 0.56 cm | 8 mm | 0.54 cm | 8 mm | 0.54cm | 8 mm |
| 3. | 0.60 cm | 10 mm | 0.60 cm | 10 mm | 0.58 cm | 10 mm | 0.57cm | 10mm |
| 4. | 0.68 cm | 11 mm | 0.68 cm | 11 mm | 0.68 cm | 11mm | 0.68cm | 11mm |
| 5. | 0.70 cm | 11 mm | 0.70 cm | 11 mm | 0.70 cm | 11 mm | 0.70cm | 11mm |
| 6. | 0.57 cm | 7 mm | 0.57 cm | 7 mm | 0.57 cm | 7 mm | 0.57cm | 7mm |
| 7. | 0.64 cm | 10 mm | 0.64 cm | 10 mm | 0.64 cm | 10 mm | 0.64cm | 10mm |
| 8. | 0.60 cm | 8 mm | 0.60 cm | 8 mm | 0.60 cm | 8 mm | 0.60cm | 8mm |
| 9. | 0.59 cm | 9 mm | 0.59 cm | 9 mm | 0.59 cm | 9 mm | 0.59cm | 9mm |
| 10. | 0.67 cm | 10 mm | 0.67 cm | 10 mm | 0.65 cm | 10 mm | 0.63cm | 9mm |

## ETHICAL APPROVAL LETTER


**KMCH ETHICS COMMITTEE**

**KOVAI MEDICAL CENTER AND HOSPITAL LIMITED**

Post Box No. 3209, Avanashi Road, Coimbatore - 641 014. INDIA

✆ : (0422) 4323800, 4323619 Fax : (0422) 4270805

E-mail : ethics@kmchhospitals.com

EC Reg. No : ECR / 112 / Inst / TN / 2013


**Ref: EC/AP/550/07/2017**

**24.07.2017**

**APPROVED**

**To**

**Dr. K. Rajendran,**

Head of the Department – Pediatrics and Neonatalogy,

Kovai Medical Center and Hospital,

Coimbatore-641 014,

Tamilnadu, India.

Dear Dr. K. Rajendran.

The proposal entitled " **Short Term Effect of Kinesiotaping in Children with Flexible Flat Foot**" submitted by **Mr. Rijo Raju Abraham** under your supervision was reviewed by the Ethics Committee in its meeting held on **22.07.2017** and permission is granted to carry out the study at **Kovai Medical Center and Hospital Ltd, Coimbatore, India.**

Thanking you,

Yours faithfully,

Dr. P. R. Muthuswamy

Chairman, KMCH Ethics Committee

20/7/17

Dr. P. R. MUTHUSWAMY,

MA.,MBA.,FDPM(IIM-A)Ph.D.,

Chairman

Ethics Committee

Kovai Medical Center and Hospital

Avanashi Road,

COIMBATORE-641 014.

**PARENT CONSENT FORM**


## KMCH ETHICS COMMITTEE
### KOVAI MEDICAL CENTER AND HOSPITAL LIMITED

Post Box No. 3209, Avanashi Road, Coimbatore - 641 014. INDIA
✆ : (0422) 4323800, 4323619 Fax : (0422) 4270805
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**KMCH ETHICS COMMITTEE MEMBERS LIST**

| S. NO | MEMBER NAME | DESIGNATION | REPRESENTATION | DESIGNATION TO THE INSTITUTION | GENDER |
|---|---|---|---|---|---|
| 1. | Dr.P.R.Muthuswamy | Principal, Dr.N.G.P Arts & Science College | Chairperson | Chairperson, KMCH Ethics Committee | M |
| 2 | Dr. Devdas Madhavan | Consultant Urologist | Member Secretary | Consultant Urologist | M |
| 3 | Dr. V.Rajamani | Consultant Rheumatologist & Physician | Clinician | Consultant Rheumatologist & Physician | M |
| 4 | Dr.K.Senthilkumar | MD-Pharmacology Pharmacologist | Basic Medical Scientist | None | M |
| 5 | Dr. A.N.Murugan | Medical Director | Clinician | Medical Director | M |
| 6 | Dr. Sangita S.Mehta | Consultant Pathologist | Clinician | Consultant Pathologist | F |
| 7 | Dr. S.Madhavi | Principal | Member | Principal, KMCH college of Nursing | F |
| 8 | Dr. K.S.G.Arul Kumaran | Professor | Basic Medical Scientist | Professor, KMCH college of Pharmacy | M |
| 9 | Dr. S.Thamil Selvi | Social Worker | Social worker | None | F |
| 10 | Mr. C.Tamil Selvan | VP-Materials | convener | VP-Materials | M |
| 11 | Mr. T.C.Dinamani | Advocate | Legal Expert | Personnel Manager | M |
| 12 | Mr.R.Krishnamoorthy | Priest | Theologist | Priest | M |
| 13 | Mr. D.Ramanathan | Office Assistant | Lay person | Office Assistant | M |

26/7/13

**Dr. P. R. Muthuswamy**
**Chairman, Ethics Committee**

Dr. P. R. MUTHUSWAMY,
MA.,MBA.,FDPM(IIM-A)Ph.D.,
Chairman
Ethics Committee
Kovai Medical Center and Hospital
Avanashi Road,
COIMBATORE-641 014.

Tapedia

# Certificate
## OF PARTICIPATION

Physioneeds Academy

This certificate of Participation is presented to

## RIJO RAJU ABRAHAM

for actively participating in Fundamental Course on **Taping - Tapedia**
and has undergone extensive theory and advanced clinical training
established by **Ashira Foundation** Trust's Board of Certification
in Coimbatore with 8 Credit hours.
Presented on 26th day of March
in the year of 2017

| | | |
|---|---|---|
| **Manjul Nautiyal**<br>Course Instructor | **Chakshu Bansal Kathuria**<br>CEO Physioneeds Academy | **Arun Bansal**<br>Founder Ashira Foundation Trust |

**REG NO : 317/COIM/TP**

## PARENT CONSENT FORM

I ~~Mr~~/Mrs Lekshmi. M am willing to let my child Ajay S participate in the research study titled "**Short term effect of kinesiotaping in children with flexible flat foot".** The researcher has explained to me about the content of his research in brief, what he needs to interview, what treatment program he is providing and has answered the questions related to the research to my satisfaction.

Date: 23/7/2017

Signature of Parent

Signature of Researcher

## PARENT CONSENT FORM

I Mr/~~Mrs~~ Subramani. P am willing to let my child Sairam participate in the research study titled "**Short term effect of kinesiotaping in children with flexible flat foot".** The researcher has explained to me about the content of his research in brief, what he needs to interview, what treatment program he is providing and has answered the questions related to the research to my satisfaction.

Date: (7/8/2017)

Signature of Parent

Signature of Researcher

## PARENT CONSENT FORM

I Mr/~~Mrs~~ Rasheeb. P.A am willing to let my child ________ participate in the research study titled "**Short term effect of kinesiotaping in children with flexible flat foot".** The researcher has explained to me about the content of his research in brief, what he needs to interview, what treatment program he is providing and has answered the questions related to the research to my satisfaction.

Date: 2/8/2017)

Signature of Parent

Signature of Researcher